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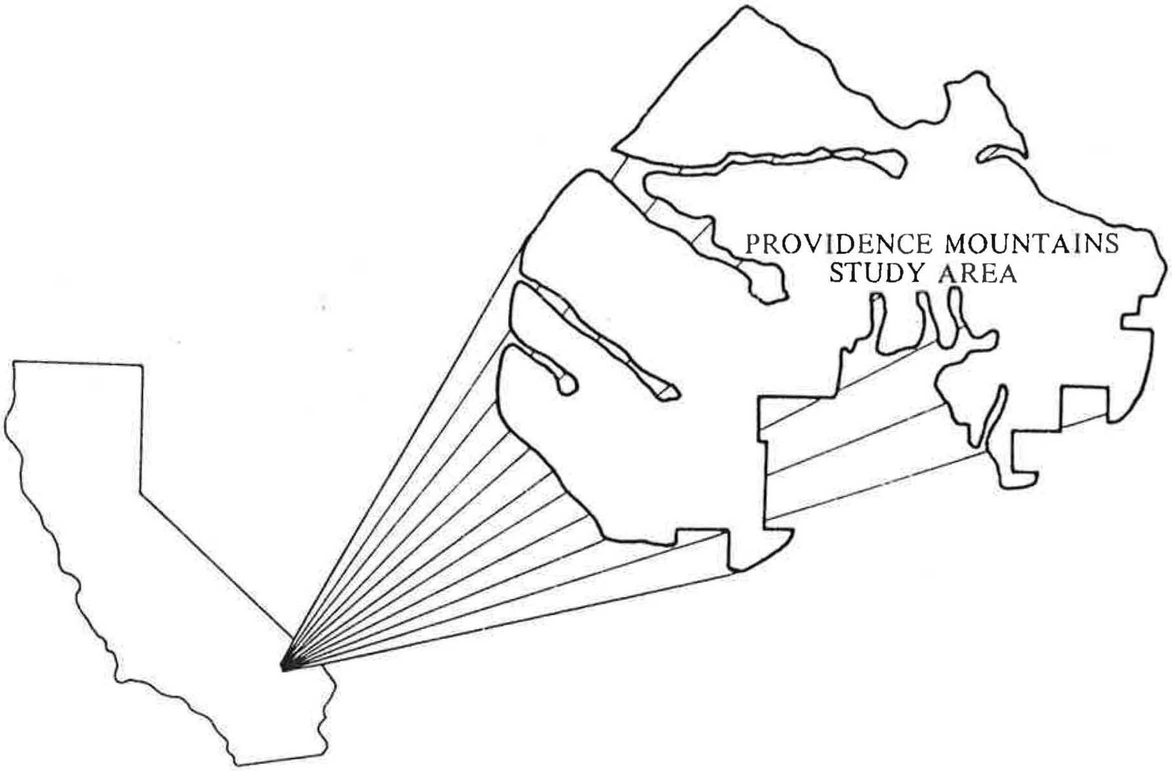
Mineral Resources of the Providence Mountains Study Area, San Bernardino County, California



BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR

MINERAL RESOURCES OF THE PROVIDENCE MOUNTAINS STUDY AREA, SAN BERNARDINO COUNTY, CALIFORNIA

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PREFACE

The Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976) requires the U.S. Geological Survey and U.S. Bureau of Mines to conduct mineral surveys on U.S. Bureau of Land Management administered land designated as Wilderness Study Areas ". . . to determine the mineral values, if any, that may be present . . . ." Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a Bureau of Mines mineral survey of the Providence Mountains study area which includes the Providence Mountains Wilderness Study Area (CDCA-263), San Bernardino County, CA.

This open-file report will be summarized in a joint report published by the U.S. Geological Survey. The data were gathered and interpreted by Bureau of Mines personnel from Western Field Operations Center, East 360 Third Avenue, Spokane, WA 99202. The report has been edited by members of the Branch of Mineral Land Assessment at the field center and reviewed at the Division of Mineral Land Assessment, Washington, DC.

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SUMMARY

From 1982 to 1984, Bureau of Mines personnel conducted a mineral appraisal of mines and prospects in the Providence Mountains study area to determine if mineral resources are present. The study was conducted under the authority of the Federal Land Policy and Management Act (Public Law 94-579, October 21, 1976). The 63,297-acre study area includes the 54,343-acre Providence Mountains Wilderness Study Area (CDCA-263) and is located in east-central San Bernardino County, California.

Rocks exposed within the study area include Precambrian gneiss and schist, Paleozoic marine sedimentary rocks, Mesozoic intrusive rocks, and Tertiary layered volcanic rocks. The north-trending, east-dipping, reverse East Providence fault cuts late Mesozoic and older rocks and is associated with several episodes of mineralization.

Twelve mines in or near the study area produced at least 6,425 tons of ore containing about 300 ounces of gold, 92,000 ounces of silver, 25,000 pounds of copper, 72,000 pounds of lead, and 2,300 pounds of zinc. The Vulcan mine-Burro prospect on the south boundary of the study area produced 2.643 million long tons of iron ore. More than 700 workings and outcrops were examined during this study, including 467 workings within and 237 workings outside the study area; they are grouped into 162 properties. Precious and base metals which occur within the study area include gold, silver, copper, lead, zinc, and molybdenum. Significant tungsten values were detected north of the study area.

Eight properties within or on the border of the study area contain a total of about 310,000 tons of identified resources of gold ± silver. Deposits range in size from 10,000 to 110,000 tons. Also within or on the border are three occurrences of gold, ranging from 500 to 3,700 tons, and one occurrence each of silver-lead, 1,300 tons, silica, 9,900 tons, and dolomite, approximately 12 million tons. Two properties contain about 340,000 long tons of iron resources ranging from 50 to 60 percent iron. Near the study area are two identified resources of silver ± gold totaling about 43,000 tons and an iron resource totaling about 3 million long tons.

All the resources are considered to be subeconomic. Approximately 310,000 tons of resources contained in eight deposits near Globe and Beecher Canyons could be reclassified as marginally economic or higher with a three- to four-fold increase in precious-metal prices or if the deposits could be mined by surface methods. The known precious-metal deposits will continue to attract exploration by private industry and recreational prospecting.

Voluminous deposits of limestone, dolomite, sand and gravel, and stone within the study area are not likely to be developed in the near future due to their relatively low bulk values and the high transportation costs to distant markets.

Minor petrified wood and fossil localities are subject to occasional recreational use.

No hydrocarbon or geothermal resources are known to occur in the study area.

INTRODUCTION

The USBM (U.S. Bureau of Mines) and the USGS (U.S. Geological Survey) each conduct mineral surveys of portions of Wilderness Study Areas 1/ designated by the BLM (U.S. Bureau of Land Management) as preliminarily suitable so that wilderness recommendations will reflect consideration of any mineral values that may be present. The USBM examines individual mines, prospects, claims, and mineralized zones, and evaluates identified mineral and energy resources. The USGS evaluates potential for undiscovered resources based on areal geological, geochemical, and geophysical surveys.

Information from these mineral surveys pertains to one aspect of the study area's suitability for wilderness classification. Although the near-term goal of these studies is to provide data for land-use decisions, the long-term objective is to help ensure the Nation an adequate and dependable supply of minerals at reasonable costs.

Throughout this report, the term study area refers to the 63,297 acres, including Federal, state, and private lands, studied by the USBM.

Setting

The 63,297-acre Providence Mountains study area includes the 54,343-acre Providence Mountains Wilderness Study Area (BLM No. CDCA-263) and is located in the east Mojave Desert region of San Bernardino County, CA (fig. 1), approximately 115 mi (miles) northeast of San Bernardino, the county seat. Most lands are Federally owned; however, five State grant sections, four patented mining claims (approximately 20 acres each), and 315 acres of railroad grant lands are included within the study area's boundaries (plate 1). In addition, eight parcels of land, containing a total of about 190 acres and mostly located on or near springs, are segregated from mineral entry (plate 1). The boundaries of the study area are somewhat irregular but are roughly defined by the Kelso-Cima Road and the Union Pacific Railroad on the west, Macedonia Canyon Road on the north, Wild Horse Canyon Road on the northeast, the

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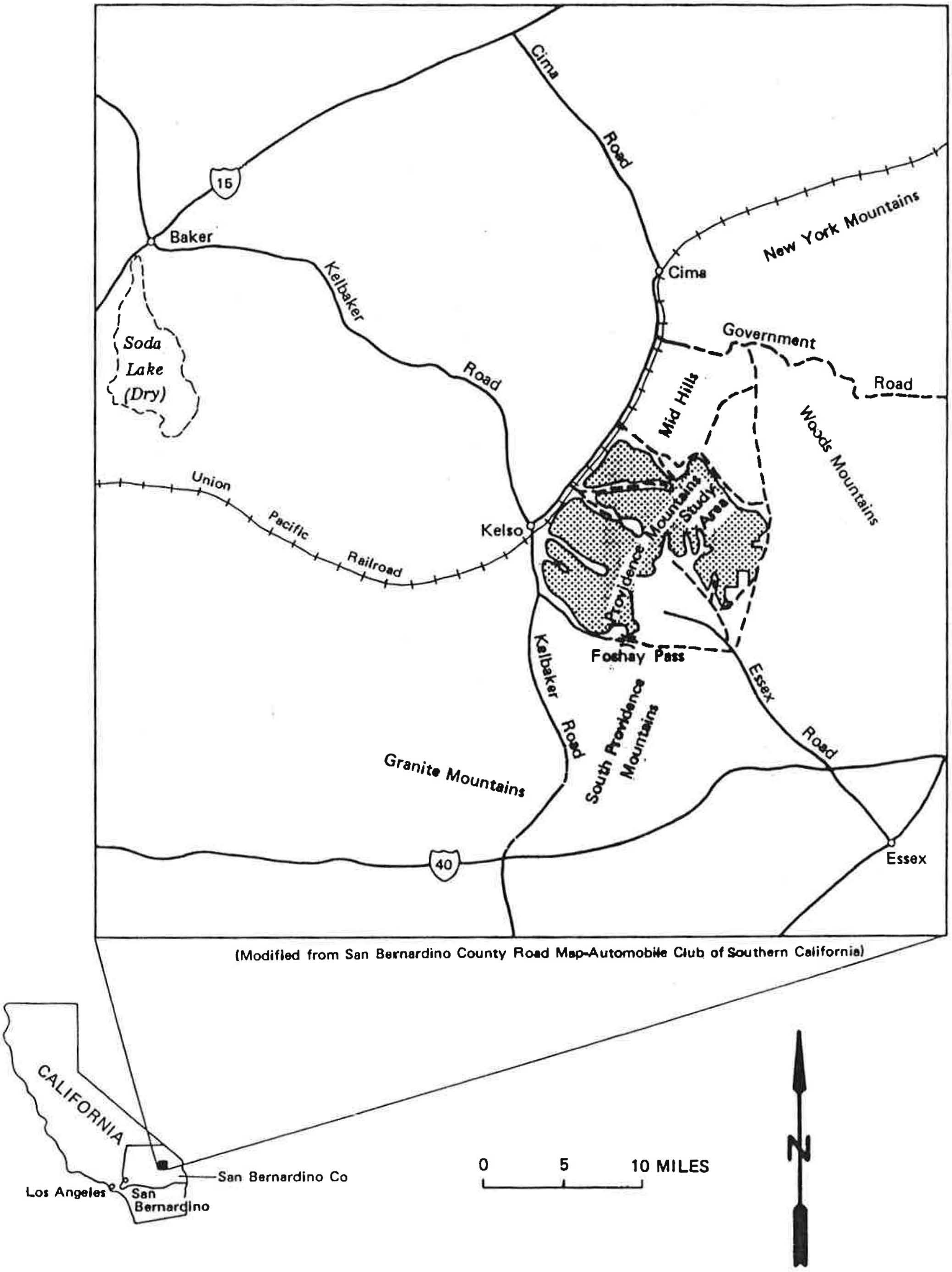
1/ A WSA (Wilderness Study Area) is a roadless area or island that has been inventoried by the BLM (U.S. Bureau of Land Management) and found to have wilderness characteristics as described in section 603 of the Federal Land Policy and Management Act and section 2 (c) of the Wilderness Act of 1964 (78 Stat. 891).



(Modified from San Bernardino County Road Map-Automobile Club of Southern California)

FIGURE 1. – Location of the Providence Mountains study area, San Bernardino County, CA

Plate 1. Mines, prospects, mineralized outcrops, and pertinent land status in the Providence Mountains study area . . . . (in pocket)

Black Canyon Road on the east, various four-wheel-drive roads on the southeast, and a pipeline service road and the Vulcan mine-Burro prospect haulage road to the south and southwest (plate 1). Adjacent to the study area, but excluded from wilderness consideration, are four avenues of access to water developments and mining claims on the west side, an area on the south containing Mitchell Caverns State Park, the Bonanza King mine (plate 1, no. 146), the 7IL (Blair) Ranch, and Bearclaw Well in the Colton Hills.

The nearest towns with commercial facilities are Cima, 10 mi north of the study area, and Essex, about 20 mi to the southeast. Kelso, a small community near the westernmost point of the study area, is owned and operated by Union Pacific Railroad. Interstate Highway 40 is 13 mi southeast of the Colton Hills by way of the Essex Road and Interstate Highway 15 is 35 mi northwest of Kelso by way of the Kelbaker Road.

Local geography is dominated by the north-northeast-trending Providence Mountains that bisect the study area (fig. 1). The area west of the mountains is mostly on alluvial fan, and the area east is comprised predominantly of Wild Horse Mesa on the northeast and the low, rolling Colton Hills on the southeast. Relief is extreme in the higher mountains from Foshay Pass on the south to Summit Spring on the north (plate 1). Elevations range from about 2,200 ft (feet) near Kelso to 7,048 ft at Mt. Edgar.

Vegetation, depending on altitude, includes pinon pine, juniper, and scrub oak at higher elevations and yucca, creosote bush, and numerous cacti in the lower areas. Higher elevations are underlain by carbonate and volcanic rocks, and relief is too severe to support abundant vegetation. Temperatures can range from near 0 °F (degree Fahrenheit) in the winter to in excess of 110 °F in the summer. Precipitation ranges from about 1 to 7 in./yr (inches per year). Although no perennial streams are present, numerous springs are active year-round, and many mine workings are flooded.

Previous Studies

The earliest published comprehensive geologic report of the area resulted from a reconnaissance of the Mojave Desert region by Thompson (1929). Hazzard (1954) conducted extensive, detailed geologic mapping of the central Providence Mountains, with emphasis on structure and the Paleozoic assemblage, and Hewett (1956) mapped the Ivanpah Quadrangle, including the north portion of the study area. Emery and Easton (1951) investigated Mitchell Caverns on the east side of the range. Some stratigraphic and paleontological studies of the area are reported by Clark (1921), Hazzard and Mason (1936), and Hazzard (1937). Investigations and mapping by Kupfer and Bassett (1962) and Bassett and Kupfer (1964) emphasizing Cenozoic geology in the southeastern Mojave Desert include the southwest corner of the study area. McCurry (1980a, 1980b, and 1982) reported on the geology and the source of Miocene pyroclastic flows which comprise Wild Horse Mesa and the nearby Woods and Hackberry Mountains. Balkwill (1964) reported on the geology of the New

York Mountains to the north, and Beckerman (1981) and Beckerman and others (1982) studied the petrology of the Teutonia batholith in the Mid Hills, including the north portion of the study area. Stone and others (1983) correlated Paleozoic strata for portions of the Mojave Desert. Geology and mineral resources in the Providence Mountain area were addressed by Southern Pacific Co. investigations of townships in the Colton Hills area (Bonham and others, 1959; Tischler and Spurck, 1960), a BLM administrative report by Vredenburgh (1982), and WSA reports on the South Providence Mountains by Miller and others (1984a) and Munts (1984).

Early mining activity and production of precious and base metals in the study area were documented in Burchard (1885), De Groot (1888, 1890), Crossman (1890), Leech (1890, 1891), and Crawford (1894). Bailey (1904) was the first to attempt a comprehensive inventory of significant properties in San Bernardino County. Activity after the turn of the century and descriptions of mineral deposits are reported by Yale (1908), Cloudman and others (1919), Jones (1920), Tucker (1921, 1924), Tucker and Sampson (1930, 1931, and 1943), Landwehr (1932), Hewett and others (1936), Jenkins (1942), Kerr (1946), Eric (1948), Wright and others (1953), and Goodwin (1957). Information on mining districts and history in general was provided by Hill (1912), Dudley and Fickewirth (1941), Clark (1970), Wong (1983), and especially Vredenburgh and others (1981).

Iron deposits in the study area were described by Jones (1909, 1916), Boalich (1923), Hodge (1935), Bain (1945), Lamey (1948), Severy (1948), Gay (1957), Moore (1971), and Scott and Wilson (1980). Ver Planck (1966) addressed potentially significant deposits of silica, including the Prospect Mountain Quartzite, and Bowen and others (1973) and Gray and Bowen (1980) reported on potentially significant carbonate deposits in the study area.

Present Study

The USBM study entailed prefield, field, and report preparation phases that spanned 1982 through 1985, and involved about four employee-years. Prefield studies included library research and perusal of San Bernardino County and BLM mining and mineral lease records. USBM, state, and other production records were searched, and pertinent data compiled. Claimants and lessees were contacted, when possible, for permission to examine properties and publish the results; in some cases, they later accompanied the authors to the property. Field studies involved searches for all mines, prospects, and claims indicated by prefield studies to be within the study area. Those found were examined and sampled, and mapped where warranted. Mines and prospects outside, but near the study area, also were studied to determine whether mineralized zones might extend into the study area, and to establish guides to mineral deposits in the region. In addition, ground and air reconnaissance was done in areas of obvious rock alteration.

Samples collected at mines, prospects, and mineralized outcrops included 1,151 rock, 39 alluvial, and 69 petrographic. Rock samples were of four types: chip, a regular series of rock chips taken in a continuous line across a mineralized zone or other exposure; random chip, an unsystematic series of chips taken from an exposure of apparently homogeneous rock; grab, rock pieces taken unsystematically from a dump, stockpile, or of float (loose rock lying on the ground); and select, pieces of rock generally chosen from the apparently best mineralized parts of a pile or exposure, or of any particular fraction (e.g. quartz, host rock). Only chip samples were used for quantitative estimates of tonnage and average grade. Grab samples of alluvium were partially concentrated on site to check for presence of gold or other heavy minerals.

Rock samples were fire-assayed for gold and silver. Presence and abundance of identified or suspected elements or compounds of possible economic significance were determined by atomic absorption, ICP (inductively coupled plasma), colorimetric, radiometric, x-ray fluorescence, or other quantitative methods. At least one sample from each locality was analyzed for 40 2/ elements by semi-quantitative spectrography to detect unsuspected elements of significance; those elements in anomalous concentrations were then determined by the appropriate quantitative method. Petrographic examinations were performed to identify selected rock types, alteration suites, and mineral assemblages. Alluvial samples were concentrated on a laboratory-size Wilfley table. Resulting heavy mineral fractions were scanned with a binocular microscope to determine heavy mineral content. If gold was detected, large particles were hand-picked and weighed; fine gold was recovered by amalgamation. Concentrates were also checked for radioactivity and fluorescence.

Site-specific geophysical surveys were made using radiometric, magnetic, and electromagnetic equipment to determine the presence of radioactive compounds, magnetite or zones leached of magnetite, and faults, geologic contacts, or sulfide-bearing zones.

Primary field map coverage for the study area included the Colton Hills, Flynn, Kelso, and Mid Hills 15' (minute of arc) (scale = 1:62,500) series topographic quadrangles and the Needles and Kingman 1^{o} (degree of arc) x 2^{o} sheets (scale = 1:250,000) published by the USGS. Other maps used included the Motorized Vehicle Interim Access Guides for the New York Mountain (no. 9) and Providence Mountains (no. 12), California Desert Conservation Area by the BLM, and the San Bernardino County and

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2/ Aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, gallium, gold, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, palladium, phosphorus, platinum, potassium, scandium, silicon, silver, sodium, strontium, tantalum, tellurium, tin, titanium, vanadium, yttrium, zinc, and zirconium.

Lake Mead road maps by the Automobile Club of Southern California. BLM 1:20,000 scale natural color aerial photographs (BLM-C-M000 1974: 13, 45-56; 14, 40-55; 15, 38-53; 16, 40-58; 17, 40-54, 18, 40-50; 19, 35-53) were used to supplement the field maps.

Identified resources are classified in this report according to definitions of the U.S. Bureau of Mines and U.S. Geological Survey (1980). Economic and marketing data and industry specifications pertinent to resources in the study area are presented in the Commodity Highlights section. A guide to approximate mining, milling, and transportation costs for several hypothetical production plans are in appendix C.

ACKNOWLEDGMENTS

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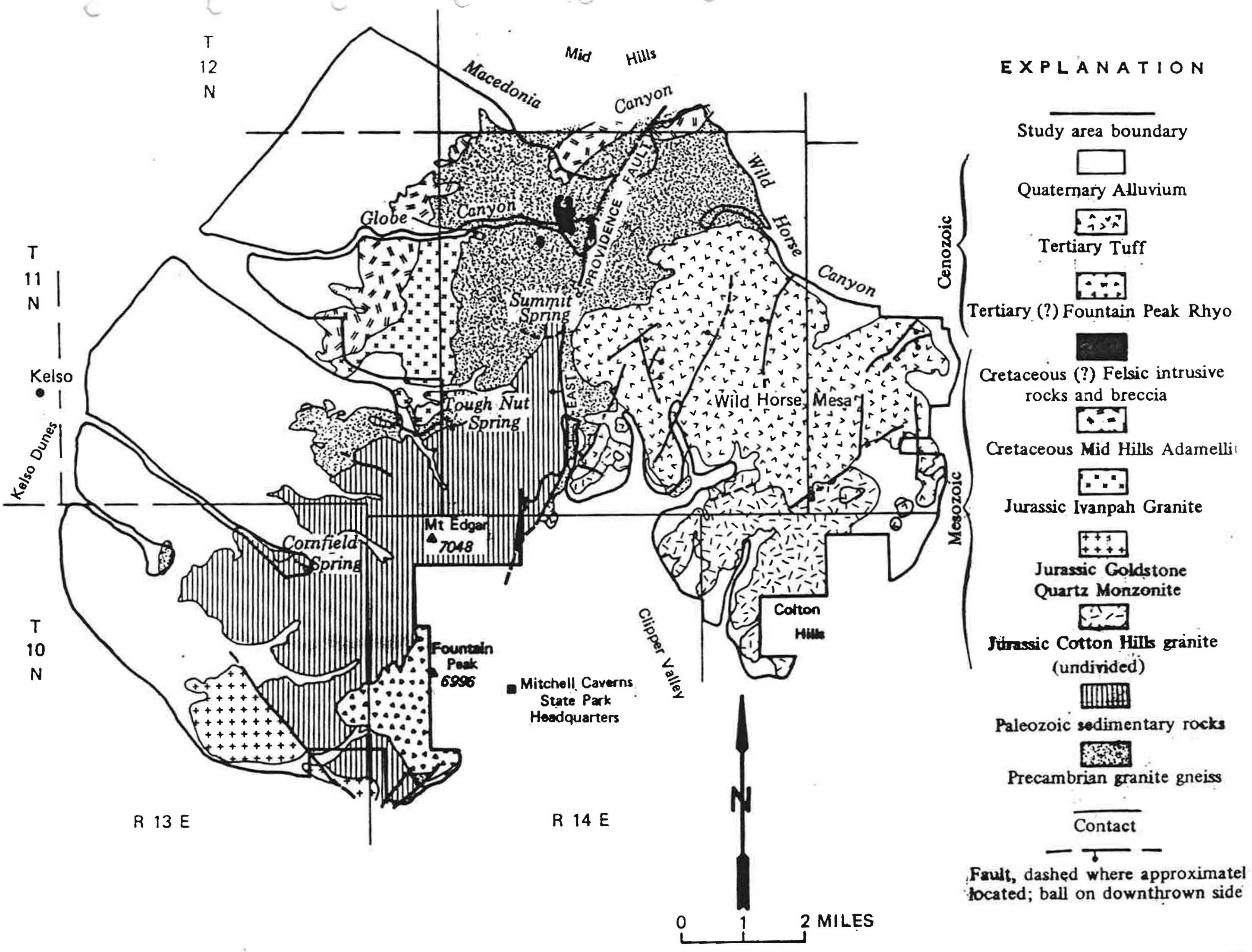
Evaluation of certain mineral properties in the study area was assisted by the contributions of several individuals and companies. Mel Lahr of American Copper and Nickel Co., Wheat Ridge, CO, and Gary Grauberger of U.S. Minerals Exploration Co., Arvada, CO, shared information on the Summit Springs-Globe Canyon area. Chris Sampson, Sampson Engineering, Vancouver, British Columbia, provided data gained during an evaluation of the Bonanza King mine for Weaco Resources Ltd. and Bolero Mines Inc. of Vancouver, British Columbia. Frank and Barbara Kirnig, Donald Sterner, and George Warren provided helpful factual data pertaining to their mining claims in the Providence Mountains. Howard Blair of the 7IL (Blair) Ranch provided historical information and directed USBM field crews to several, previously unreported mines in the study area. The authors greatly appreciate the skill of the helicopter pilots from Landells Aviation and Oliver Helicopters.

GEOLOGIC SETTING

Rocks exposed in the Providence Mountains study area (fig. 2) are of four main types: Precambrian Era gneisses and schists, Paleozoic Era sedimentary rocks, Mesozoic Era intrusive rocks, and Cenozoic Era volcanic rocks. Precambrian metamorphic rocks form about half of the exposed basement complex and are overlain by marine quartzites, shales, and carbonate rocks deposited from the Cambrian through Triassic Periods. This complex was intruded by at least four granitic plutons of Mesozoic age. Some of these Mesozoic intrusive rocks were formerly shown



Geology modified from Hazzard (1954 and Miller and others (1984b)

FIGURE 2. — Generalized geologic map of the Providence Mountains study area

by Jennings (1961) and Bishop (1963) as Precambrian igneous and metamorphic rocks. The eastern lobe of the study area is covered by nearly horizontal extrusive volcanic rocks, predominantly rhyolite tuffs, of Tertiary age. A large, intensely weathered and altered rhyolite plug of Tertiary age (Hazzard, 1954) or older (Miller and others, 1984a, p. 6) was emplaced in predominantly Paleozoic rocks near the south end of the study area. The lower west and east flanks of the Providence Mountains are covered by alluvial fans. Alluvium- or eluvium-filled basins lie to the west (Kelso Dunes) and southeast (Clipper Valley). Mountains to the north (Mid Hills) and south (south Providence Mountains) are of predominantly granitic composition.

Precambrian metamorphic rocks host many of the precious- and base-metal deposits in the study area, especially in proximity to Mesozoic plutons and dikes. The Precambrian rocks consist of granite gneisses, schists, and amphibolites and crop out over an extensive area in the northern portion and probably underlie younger rocks in the central and eastern portions of the study area (Hazzard, 1954; Hewett, 1956). The gneissic rocks are weathered and are commonly hydrothermally altered near intrusive contacts, faults, and shear zones. They are intensely faulted and sheared and have a high permeability for the circulation of meteoric and hydrothermal solutions.

The Paleozoic sedimentary rocks are a predominantly marine carbonate assemblage which dips slightly eastward to form a spectacular series of high peaks along the crest of the central Providence Mountains. Mineral deposits in the Paleozoic section consist of iron skarns in limestones or dolomites near intrusive Jurassic rocks and fault-controlled silver-lead-zinc replacement deposits in carbonate rocks. Hydrothermally altered carbonate rocks are commonly bleached and in some places silicified; breccia zones in carbonate rocks are commonly healed by earthy iron oxides.

The Mesozoic rocks of the Providence Mountains include at least four granitic plutons and several sets of dikes, most of intermediate to felsic composition. The proximity of Mesozoic intrusive rocks to most of the known metallic mineral deposits in the study area suggests a genetic association. Three distinct plutons of Jurassic age are identified: 1) Ivanpah Granite; 2) Goldstone Quartz Monzonite; and 3) undivided granite of Colton Hills. The Ivanpah Granite crops out north of Tough Nut Spring as a 1-mi-wide by 3-mi-long, north-trending belt of weathered rocks between Precambrian gneiss on the east and Cretaceous granitic rock on the west. The Goldstone Quartz Monzonite, named syenite by Hazzard (1954), forms much of the southern Providence Mountains. It crops out along the Hidden Hill Fault contact with the Paleozoic assemblage in the Foshay Pass area. Specular hematite (Fe_2O_3) fracture filling is common in both the Ivanpah Granite and the Goldstone Quartz Monzonite. Plutonic rocks of Jurassic age in the Colton Hills were described as undivided granites (Miller and others, 1984b). Bonham and others (1959) and Tischler and Spurck (1960) described the main rock bodies in the Colton Hills as ranging in composition from quartz monzonite to granodiorite with some dioritic or more mafic composition locally.

The Mid Hills Adamellite, a Cretaceous pluton, crops out in the northern and northwestern portions of the study area and represents a significant part of the Mid Hills (Beckerman, 1981). The rock is commonly propylitized or altered to quartz-sericite in the vicinity of faults, shear zones, and localized intrusives. From Macedonia Canyon to the Globe Canyon area, the pluton underlies a thin veneer of Precambrian metamorphic rocks which thicken to the south towards Summit Spring. A number of altered, felsic intrusive dikes and breccias, which intrude apparent zones of weakness in the Globe Canyon and Summit Spring areas, have recently been the focus of exploration for stockwork molybdenum and large tonnage, low-grade gold deposits.

The Fountain Peak Rhyolite forms a large intrusive mass along the crest of the Providence Mountains north of Foshay Pass (plate 1). A network of rhyolite dikes related to the intrusive body radiate to the north along zones of weakness in the Paleozoic assemblage. Several prospects in carbonate rocks near the Fountain Peak Rhyolite contact contain significant quantities of copper ± gold, silver, and lead. Mines and prospects in proximity to the contact suggest the rhyolite intrusive body is the source of these metals. Deposited upon the Precambrian and Mesozoic basements is a 1,000-ft-thick section of slightly south-dipping, silicic, pyroclastic flows of Miocene age which now form Wild Horse Mesa.

Alluvial fans have accumulated at the bases of the steeper slopes. Due to their steepness, drainages in the higher elevations are generally scoured of sediments. Because of the abundance of lime in run-off and ground water, caliche-cemented zones in the alluvial fans are common and are as much as 20-ft thick. Some placer gold may be perched on false bedrock formed by the caliche horizons. Minor concentrations of placer gold are associated with fluvial deposits downstream from lode gold occurrences.

Several major faults and numerous shear zones cut rocks within and adjacent to the study area. The most prominent is the East Providence fault zone which trends north-northeast through the eastern flank of the range (fig. 2). The East Providence Fault is the most important structural conduit in the study area. Along one-half of its exposure in the study area, it forms a very distinct contact between Paleozoic carbonate rocks on the west and Precambrian or Mesozoic crystalline rocks on the east; however, the fault is difficult to trace where it cuts only crystalline rocks. David Miller (personal commun., 1984) considered the fault to be as old as Jurassic with subsequent periods of reactivation. Fault deformation of relatively incompetent Precambrian metamorphic rocks in the area from Summit Spring to Macedonia Canyon is commonly spread over a zone as wide as 500 ft, rather than along a distinct trace. Associated with this major fault are many splinter faults, intensely altered zones, local intrusions such as the felsic rocks in the Globe

Canyon area, and numerous mineralized zones. The northwest-trending Hidden Hill Fault (Miller and others, 1984a, p. 6), a second major structural feature, juxtaposes Jurassic and Paleozoic rocks in Foshay Pass and may be the controlling feature for the Vulcan mine iron ore body as well as precious-metal deposits to the southeast and northwest.

Numerous localized faults cut rocks of the Paleozoic assemblage and generally controlled the deposition of iron and silver-lead-zinc in the sedimentary rocks. All of the major plutons as well as Precambrian metamorphic rocks are cut by local faults and shear zones which controlled mineral deposition, especially near intrusive contact zones. Fault intersections are commonly associated with larger mineral deposits.

MINING HISTORY

Exploration and mining activity in the region began in 1863. More than 1,200 mining claims have been located since 1900. In 1982, nearly 300 remained actively held in and contiguous to the study area, and oil and gas leases or lease applications were filed on approximately 18,000 acres within the study area. San Bernardino County mining claim records are incomplete and unorganized prior to 1900, but thereafter are relatively complete and show peak mining claim activity from 1900 to 1910, 1930 to 1940, about 1960, and about 1980. Since the earliest documented production in 1871, at least 14 mines within or adjacent to the study area have produced one or more of the following metallic commodities: gold, silver, copper, lead, zinc, tungsten, and iron. Recorded production by mine is listed in table 1. Seven mines in or partly outside of the study area produced 152.02 oz (troy ounces) of gold, 2,411 oz of silver, 507 lbs (pounds) of copper and 2,839 lbs of lead. Four mines outside the area produced 145.68 oz of gold, 89,251 oz of silver, 24,891 lbs of copper, 69,375 lbs of lead, and 2,312 lbs of zinc. Also outside the area, the Vulcan mine-Burro prospect produced 2.643 million long tons (2,240 lbs per long ton) of iron ore. In addition, small shipments of tungsten were made from the Blue Rock nos. 1-6 mine (Confidence Copper mine) in 1918 (Partridge, 1941, p. 306), small shipments of gold ore were made from the SS Nos. 20-22, 27-29 mine, south (Star [?] mine) about 1914-1915 (Wright and others, 1953), and high-grade gold and silver with lead were shipped from the Globe mine from 1910 to 1930 (Tucker and Sampson, 1930, p. 213; 1931, p. 272). Early production (1883-1887) from the Bonanza King mine probably consisted of silver with moderate lead and minor gold and copper. Ore totaling $3,000 in value, probably silver and lead, was taken from the Silver King mine around 1889-1890 (Leech, 1890, p. 105; 1891, p. 109). Because of incomplete data, the reported figures are probably only a fraction of the total production.

Early mining history of the Providence Mountain Range began in 1863 with the discovery of silver and the organization of the Rock Spring mining district (Vredenburgh and others, 1981) which extended from the Mid Hills south to Macedonia Canyon along the north boundary of the study area (fig. 3). The townsite of Providence was founded in late 1863 in Macedonia Canyon (sec. 34, T. 12 N., R. 14 E., S.B.M.), and the Macedonia

TABLE 1.--Recorded production from nonferrous metallic lode deposits within and adjacent to the Providence Mountains study area

(*, outside the study area; **, partly within the study area; NR, not reported)

(Underlined name is mine of record)

Map no. (plate 1)	Property name	Year of production	Tons produced	Gold produced (oz)	Silver produced (oz)	Copper produced (lb)	Lead produced (lb)	Zinc produced (lb)	Reference
10	Silver Buddy mine	1965	10	NR	22	1	142	NR	U.S. Bureau of Mines statistical files.
18*	Blue Rock Nos. 1-6 mine (Confidence Copper mine)	1918	200	NR	2,435	10,626	NR	NR	Hewett, 1956, p. 143.
22*	Francis mine	1917-1918	200-307	NR	2,377	10,626	NR	NR	U.S. Bureau of Mines statistical files; Tucker and Sampson, 1930, p. 213; 1931, p. 272.
23*	Castor-Pollux mine (Macedonia mine)	1871-1872	15	NR	NR	NR	NR	NR	Vredenburgh and others, 1981, p. 89.
	(Columbia mine)	1926-1938	142	89.11	2,167	2,726	100	NR	U.S. Bureau of Mines statistical files.
38**	SS Nos. 20-22, 27-29 mine, south (Star Mine)	1898-1901	NR	16.93	NR	NR	NR	NR	U.S. Bureau of Mines statistical files.
64 69	Frisco No. 3 mine or Double H Nos. 1 and 2 mine	1930-1931	106	44.11	54	329	NR	NR	U.S. Bureau of Mines statistical files.
72	Providence mine	1918	12	NR	445	166	2,465	NR	U.S. Bureau of Mines statistical files.
96**	Jo Je mine	1937-1942	185	72	392	NR	NR	NR	U.S. Bureau of Mines statistical files.
122**	Rex mine	1934-1951	126+	12	9	NR	NR	NR	U.S. Bureau of Mines statistical files; Wright and others, 1953.
144*	Silver King mine (Perseverance mine)	1918-1920	20	6.98	1,489	11	232	NR	U.S. Bureau of Mines statistical files.
146*	Bonanza King mine	1901-1960	5,302+	56.57	82,272	913	69,275	2,312	U.S. Bureau of Mines statistical files.
150 or 153	Grande 1-7 mine or Max Dor 1-2 mine	1980	100	NR	NR	NR	NR	NR	Vredenburgh, 1982, p. 37.

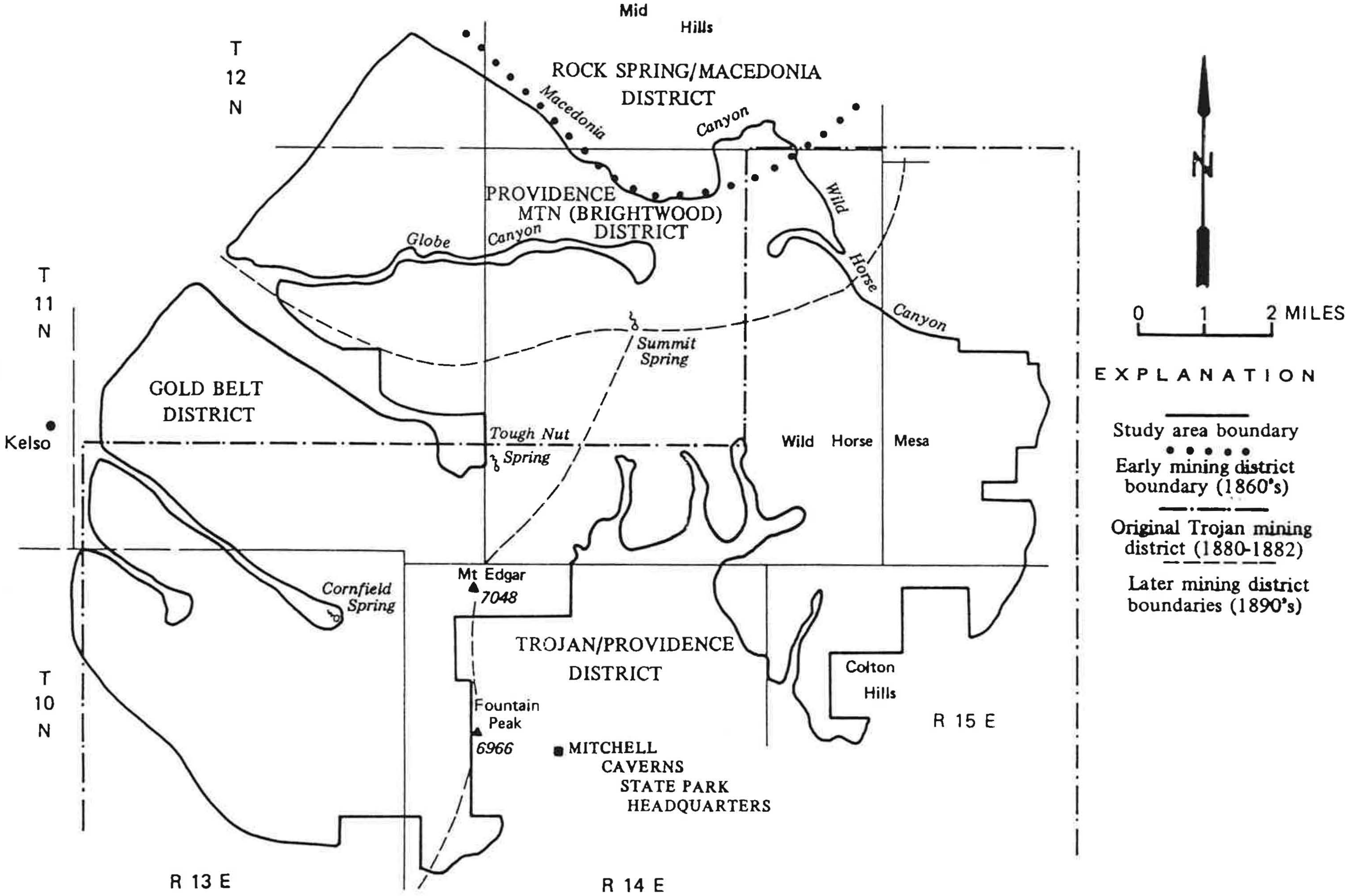

Mid Hills
ROCK SPRING/MACEDONIA DISTRICT
Macedonia Canyon
PROVIDENCE MTN (BRIGHTWOOD) DISTRICT
Globe Canyon
Wild Horse Canyon
Summit Spring
Tough Nut Spring
GOLD BELT DISTRICT
Kelso
Wild Horse Mesa
Cornfield Spring
Mt Edgar
7048
TROJAN/PROVIDENCE DISTRICT
Colton Hills
Fountain Peak
6966
MITCHELL CAVERNS STATE PARK HEADQUARTERS
T 12 N
T 11 N
T 10 N
R 13 E
R 14 E
R 15 E
N
0
1
2 MILES
EXPLANATION
Study area boundary
Early mining district boundary (1860's)
Original Trojan mining district (1880-1882)
Later mining district boundaries (1890's)

FIGURE 3.– Historic mining districts in the Providence Mountains study area

mining district was subdivided from the Rock Spring mining district by November 1864. The Macedonia (later known as the Caster-Pollux and the Columbia) mine deposit was apparently discovered during this time period. When Indian troubles began in 1866, the district was abandoned. During a resurgence of mining activity in 1871 and 1872, 15 tons of ore (valued at $650 per ton) were shipped from the Macedonia mine (San Bernardino Guardian, June 29, July 13, and September 21, 1872).

The Trojan mining district was organized, and the town of Providence (Dudley and Fickewirth, 1941, p. 22-23) settled in April 1880 after high-grade silver ore was discovered at the Bonanza King mine. The district, with its northeast corner at McGilvoy millsite (sec. 27, T. 11 N., R. 14 E. S.B.M.), extended 10 mi to the west and 20 mi south. In 1882, a 5- by 25-mi area was added to the east side. Later references (Crossman, 1890, p. 223; Hill, 1912; Clark, 1970; and Wong 1983) indicate the Trojan district was divided into three mining districts: the Gold Belt district on the west side of the Providence Mountains, the Providence Mountain/Brightwood district on the north side, and the Trojan/Providence district on the east side (fig. 3). Many claim notices near Kelso also refer to the Kelso mining district.

The Bonanza King mine was developed and producing by 1883. The mine consists of approximately 20,000 ft of underground workings to a depth of 800 ft (Wright and others, 1953, p. 72-73, tables) and is the largest underground mine in the Providence Mountains. DeGroot (1890, p. 532) reported that the mine received $60,000/month from ore averaging $100/ton and The Mining World (Feb. 6, 1906, p. 225) noted total production in the 1880's was worth $1.8 million. Most production ended when the original 10-stamp mill burned to the ground in July 1885. Subsequent ore was processed at nearby mills, one of which was at the Silver King mine (Perseverance mine) which operated from 1889-1890.

After closure of the Bonanza King mine, exploration and mining activity in the 1890's spread generally to the mountains south of Foshay Pass (Plate 1). Exploration was renewed in the northern Providence Mountains about 1900 and resulted in the discovery of several precious-metal deposits, iron deposits in Foshay Pass and the southwestern part of the study area, and the reopening of the Bonanza King mine.

Mining activity increased during the World War I era. Production up to World War II from the Castor-Pollux (Columbia mine, Macedonia mine), Globe, Frisco No. 3, Double H Nos. 1 and 2, Jo Je, and Rex mines was sporadic until Kaiser Steel Corp. brought the Vulcan mine-Burro prospect into production in 1942. The Vulcan mine-Burro prospect produced 2.643 million long tons (Wright and others, 1953) of blast-furnace-grade iron ore from a large open pit in Foshay Pass, 1/4 mi outside of the study area. Production ceased in 1947 with the acquisition and development by Kaiser of the Eagle Mountain deposit, near Desert Center, CA. After

World War II, only minor production was reported from the Silver Buddy, Rex, and Bonanza King mines and, possibly, the Grande 1-7 or Max Dor 1 and 2 mines. Several mines and prospects (Bell McGilroy, Mitchell, Mexican, etc.), which were worked primarily from the 1940's to the early 1960's (Wright and others, 1953; USBM statistical files), are within the Mitchell Caverns State Park on the southeast side of the study area.

Several exploration and preliminary development programs have been initiated by private industry in the Providence Mountains since 1960, expecially after precious-metal prices increased in 1974. In the early 1960's, U.S. Steel Corp.'s extensive exploration for iron deposits focused on a hypothetical eastern extension of the "Vulcan" iron body in Foshay Pass, but exploration extended as far as the 7IL (Blair) Ranch.

Since 1969, the study area from Summit Spring north to Macedonia Canyon was the focus of molybdenum or gold exploration programs by Geodata Inc., Rioamax, and American Copper and Nickel Co. Currently, U.S. Mineral Exploration Co., Piute Canyon Mines, Inc., of Bishop, CA, and Raines Resources of Canada have located claim groups, some of which are in the Summit Spring and Globe Canyon area.

An intense exploration and preliminary development program by Weaco Resources, Ltd. and Bolero Mines Inc. of Canada has centered on the Bonanza King mine since the late-1970's. Production Exploration Resources of Tonopah, NV, has been exploring the nearby Silver King mine. Brownstone Mining Co. in 1979 experimented on tailings with a pilot agitation-vat cyanide leach plant located at the original Bonanza King mill north of the 7IL (Blair) Ranch. The metallurgical and recovery results are not known.

Four companies held more than 18,000 acres of the study area under oil and gas lease or lease application according to 1982 BLM oil and gas plats. The leases covered the structure basins around the study area and generally exclude the higher elevations except for a few square miles south of Cornfield Spring.

COMMODITY HIGHLIGHTS

The principal mineral commodities within and adjacent to the Providence Mountains study area are gold, silver, copper, lead, zinc, iron, limestone and dolomite, and silica. Identified resources are subeconomic, but because commodity prices vary with supply and demand, what is not minable today may be minable in the future. Mining methods for these resources range from underground methods for high-value, small to moderate tonnage deposits to open-pit methods for moderate or large tonnage, low-grade deposits. Production costs are dictated by size and depth of the deposit, amenability to metallurgical treatment, accessibility, and distance to market. Market conditions and the degree of dependence of the United States on foreign sources for various commodities are also important factors affecting resource values. Table 2 summarizes uses, domestic production, consumption, import sources, import reliance, price, and expected market growth for the principal metallic commodities in or near the study area. Limestone and dolomite, and silica are discussed below.

Critical factors affecting the economic minability of limestone and dolomite include the grade, size, and accessibility of each deposit, as well as proximity to transportation and refining facilities, and markets. Danner (1966, table 11, p. 55) and Bowen and others (1973, table 7, p. 43-44) list the principal chemical and physical specifications of the consuming industries for limestone and dolomite. More than half of the uses, such as CaO (lime), steel flux, chemical, glass, paint and filler, and beet-sugar, require $CaCO_3$ (calcium carbonate) grades of 96 percent or more. For instance, manufacturers prefer limestone with more than 99 percent $CaCO_3$ for chemical uses. However, the cement, aggregate, and fertilizer industries whose $CaCO_3$ specifications are lower, are the dominant consumers of limestone production. Grade specifications for dolomite are highly variable. For both limestone and dolomite, the amount of MgO (magnesia), Fe_2O_3 (ferric oxide), Al_2O_3 (alumina), SiO_2 (silica), and other compounds may be critical depending on the use. Applications for which the limestone and dolomite in the study area may be chemically suitable are shown in table 3. Thirteen limestone and/or dolomite mines were active in the Mojave Desert Province in 1973 (Bowen and others, 1973, plate 1). Based on the total value of production by commodity in San Bernardino County, cement (portland) was second and lime was eighth in 1981 (Carrillo and others, 1984). There were approximately the same number of producers in 1981 as in 1973.

In 1980, 770 million short tons of crushed stone aggregate were used in the United States; approximately 69 percent came from limestone and dolomite sources (Schenck and Torries, 1983, table 1). Common uses include roadbase, concrete, surface treatment, riprap, railroad ballast, fill, and unspecified aggregate. Due to the high-bulk/low-unit value of crushed stone ($3.69/ton in 1981; Schenck and Torries, 1983, p. 62), transportation costs are critical to profitable operations; therefore, local sources are used where available.

California industrial-grade quartzite is used predominantly for portland cement, which requires various amounts of SiO_2 depending on the type of processing plant. Most of the remainder is used for the manufacture of refractory silica brick. A typical chemical specification for quartzite used by industry in silica brick requires at least 96.40 percent SiO_2, and less than 0.15 percent Al_2O_3, 0.59 percent Fe_2O_3, 0.04 percent TiO_2 (titania), 2.49 percent CaO, 0.08 percent MgO, 0.12 percent Na_2O (sodium oxide), and 0.02 percent LOI (loss on ignition) (Ver Planck, 1966, p. 40).

Major producers of ferrosilicon and silicon metal prefer quartzite which contains 98 percent or more SiO_2 (Kuck, 1980, p. 813). Ver Planck (1966) further notes that most users of pulverized quartzite

TABLE 2.--Summary of commodities in the Providence Mountains study area

(Commodity statistics are from U.S. Bureau of Mines Mineral Commodity Summaries - 1984, 1985)

Commodity	1984 Domestic mine production 1/	1984 Apparent consumption 1/	Units (millions)	Major import sources	Net import reliance (percent) 2/	Average 1984 domestic price (dollars)	Price unit	Expected U.S. demand through 1990	Major uses
Gold	2.3	4.8	Troy ounces	Canada Switzerland Uraguay	16	365.00	Troy ounce	Annual increase rate of 2.0%	Jewelry and arts, industrial (mainly electronic), and dental.
Iron ore	51.0	64.0	Long tons	Canada Venezuela Liberia Brazil	19	30.03-32.78 3/	Long ton	Annual decrease rate of 2.0%.	Iron, steel, and heavy media materials.
Lead	.375	1.14	Short tons	Peru Honduras Canada Mexico	18	0.25	Pound	Annual increase rate of 1.3%.	Batteries, gasoline additives, construction paint, ammunition, electrical, ceramics, and glass.
Silver	44.0	170.0	Troy ounces	Canada Mexico Peru United Kingdom	61	8.25	Troy ounce	Annual increase rate of 2.2%.	Photography, electrical and electronic products, sterlingware, electroplated ware, jewelry, brazing alloys, and solders.
Copper	1.16	2.3	Short tons	Chile Canada Mexico Peru	21	.66	Pound	Annual increase rate of 1.8%.	Building construction, electrical and electronic products, industrial machinery and equipment, transportation.
Zinc	.292	1.136	Short tons	Canada Peru Mexico	67	.48	Pound	Annual increase rate of 2.2%.	Construction materials, transportation, machinery, and electrical.
Tungsten	.0014	.012	Short tons	Canada China Bolivia	71	79.82	Stu WO_3 4/	Annual increase rate of 15.9%.	Metal working and construction machinery, transportation, lamps and lighting, and electrical.

1/ Estimated
2/ Defined as imports - exports + adjustments for Government and industry stock changes.
3/ At a grade of 51.5% iron.
4/ A short ton unit (stu) of tungsten trioxide (WO_3) contains 20 lbs of tungsten.

TABLE 3.--Principal chemical specifications of the consuming industries for limestone and dolomite

(NA, not applicable; $\geq$, equal to or greater than; $\leq$, equal to or less than)

Use	Chemical requirements 1/				
	$CaCO_3$ (%)	MgO (%)	$Na_2O + K_2O$ 2/ (%)	$Al_2O_3 + Fe_2O_3$ (%)	SiO_2 (%)
Portland cement (limestone)	$\geq$75-82	$\leq$2-3	$\leq$0.5	NA	NA
Agricultural (limestone or dolomite)	3/	3/	NA	NA	NA
Textile dyeline (limestone)	$\geq$94	$\leq$3	NA	$\leq$2	$\leq$2.5
Pulp and paper (limestone)	$\geq$95-96	$\leq$3	NA	$\leq$0.5	$\leq$1.5
Rock wool (limestone)	$\geq$45	NA	NA	NA	$\leq$55
Magnesian limestone	NA	10-15	NA	NA	NA
Refractory (dolomite)	NA	$\geq$18	NA	$\leq$2	$\leq$1

1/ Individual industrial/consumer specifications may vary considerably from those listed.

2/ K_2O = potash

3/ Total of carbonate minerals ($CaCO_3 + CaMg[CO_3]_2$) is $\geq$75%-85%.

require a high degree of whiteness in addition to chemical purity. Other physical parameters important to industry include the structure and degree of recrystallization of quartz grains.

MINES, PROSPECTS, CLAIMS, AND MINERALIZED AREAS

One hundred sixty-two sites examined during this study are shown on plate 1. Lode mines, prospects, and claims, except for those in the Colton Hill area, occur in a belt that trends north to northeast from Foshay Pass to Macedonia Canyon (plate 1) and roughly parallel to the overall trend of the East Providence fault (fig. 2). Precious- and base-metal assemblages are predominant in the structurally-controlled deposits and occurrences in this belt, but some metasomatic replacements occur in carbonate-rich rocks. The metallic deposits and occurrences may be roughly grouped into six geographic areas according to host rock, mineral or metal assemblage, and type of occurrence. The important characteristics of the Macedonia, Globe Canyon-Summit Spring, Tough Nut Spring, Fountain Peak-Foshay Pass, East Providence fault zone, and Colton Hills areas (fig. 4), as well as placer gold occurrences, are described in the section on precious, base, and other nonferrous metals. Following that are sections on iron and several industrial minerals. Important mines and prospects are described in detail in appendix A; all mines, prospects, and mineralized outcrops are summarized in appendix B.

Precious, Base, and other Nonferrous Metals

Macedonia Canyon Area

Twenty-four properties in this area (fig. 5, nos. 1-24), include four past producers of silver and copper ± gold and lead. The deposits occur as quartz veins, shear zones, and faults which trend east to northeast and generally dip to the southeast, and cut granitic rock of the Mid Hills Adamellite or metamorphic rock in very close proximity to the intrusive. Within or on the border of the study area are 7 shafts, 6 trenches, 1 adit, and 20 pits. Adjacent to the study area, there are 17 shafts, 11 adits, 6 trenches and 58 pits. Mineralized zones commonly exhibit evidence of several episodes of brecciation and cementation; gneissic wallrock is generally intensely altered and replaced with silica. Pyrite (FeS_2), chalcopyrite ($CuFeS_2$), galena (PbS), and sphalerite (ZnS), along with their oxidation products, are associated with quartz veins and silicified zones. Fluorite (CaF_2) was observed in veins and wallrock at several properties and traces of wolframite ($[Fe,Mn]WO_4$), scheelite ($CaWO_4$), and huebnerite ($MnWO_4$) were detected in petrographic and microprobe analyses of samples from the Blue Rock Nos. 1-6 mine (Confidence Copper mine) (fig. 5, no. 18). The properties in the Macedonia Canyon area are generally distinguished from those to the south in the Globe Canyon-Summit Spring area by their higher silver-to-gold ratios, the more common presence of base metals, and their close proximity to the Mid Hills intrusion. Much of the contact zone lies outside the study area.

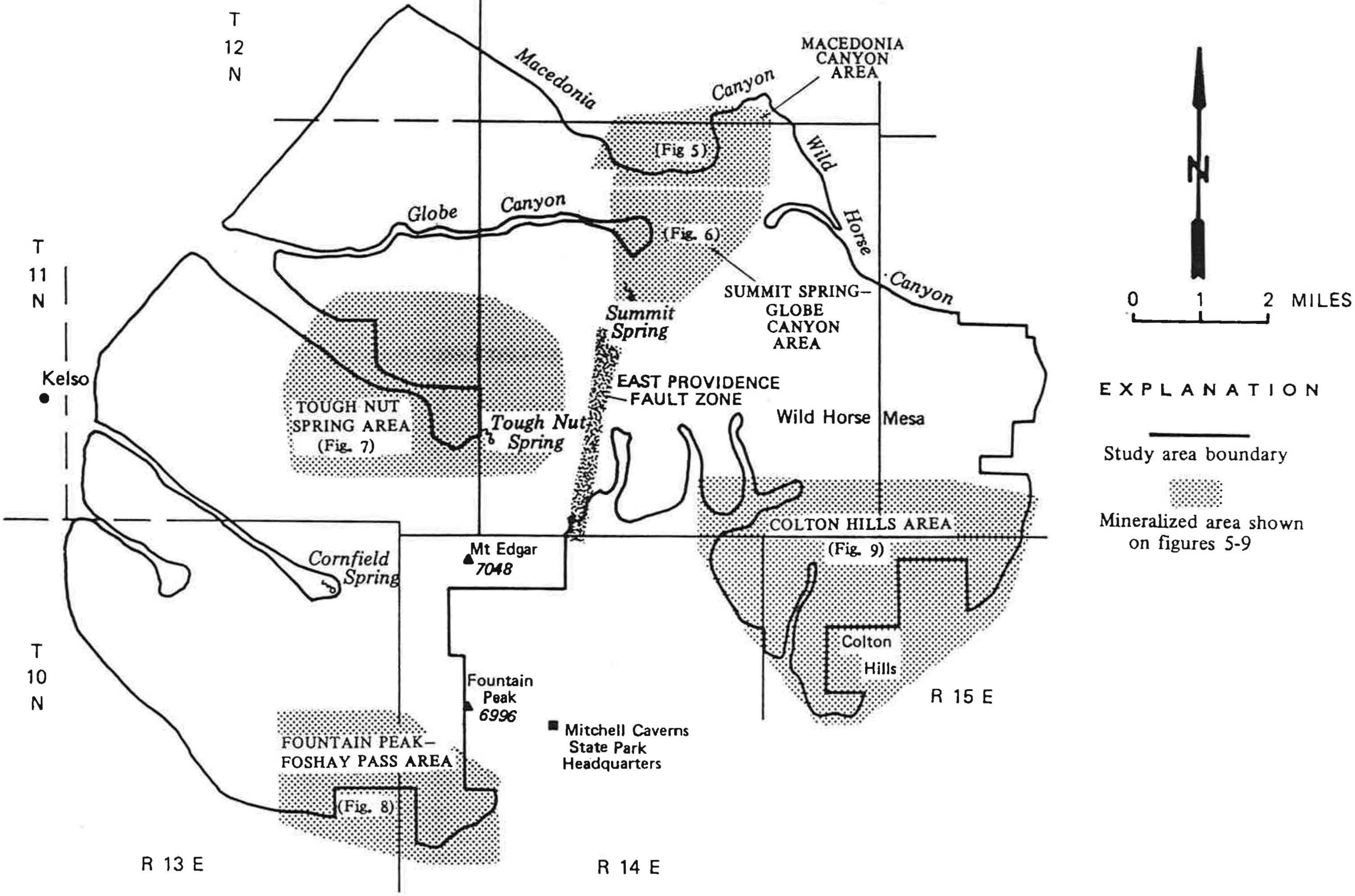


FIGURE 4. – Index to mineral areas, figures 4–8, Providence Mountains study area

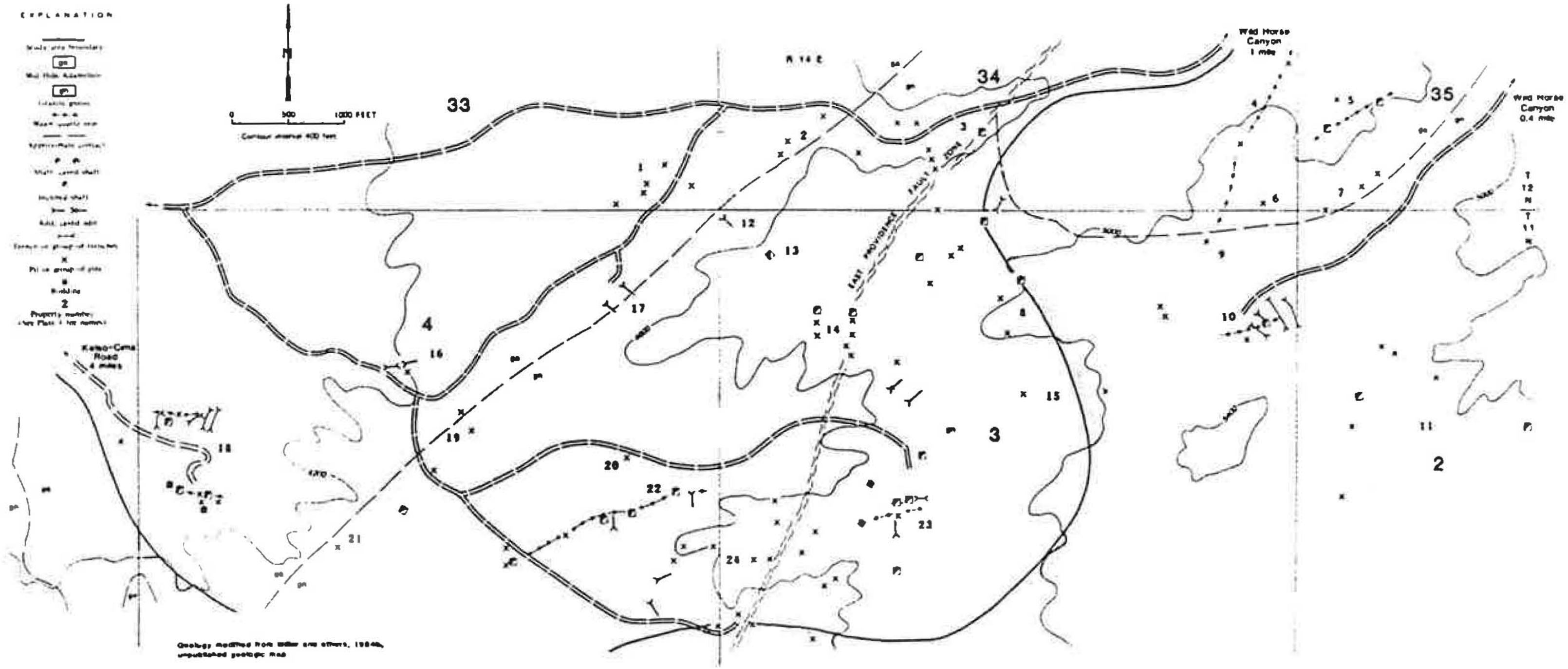


FIGURE 5.– Mines and prospects in the Macedonia Canyon area

The East Providence fault zone, mapped by Miller and others (1984b), trends north-northeast through the Fremont-Easy Street prospect, (fig. 5, no. 14) and is well exposed on the Regulus-Vega-Spica prospect (Silver Fox shaft) (fig. 5, no. 3) in Macedonia Canyon. The fault is subparallel to the general deformation fabric of this area, and was probably the primary distribution system for intermittent mineralizing solutions in this area as indicated by the proximity of well-mineralized deposits to the East Providence fault.

The Francis mine and the Castor-Pollux mine (Columbia mine, Macedonia mine) are described in detail with accompanying maps and tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Globe Canyon-Summit Spring Area

Thirty-nine mines and prospects, including four past producers of gold and silver ± copper, are within 1 mi of the East Providence fault zone (fig. 6). Mineralized zones are generally quartz veins, shear zones, and faults that trend east to northeast, and are associated with irregular, brecciated, felsic intrusions in weathered, intensely hydrothermally altered Precambrian gneiss and schist. Within or on the border of the study area, there are 29 shafts, 43 adits, 4 trenches, and at least 63 pits. Within a corridor excluded from the study area are three shafts, two adits, one trench, three pits, and two isolated quartz outcrops (fig. 6, nos. 43 and 52). The mineralized properties in the Globe Canyon-Summit Spring area differ from those to the north by higher gold-to-silver ratios, the general lack of significant concentrations of base metals, and the proximity to felsic intrusions. Several prospects to the west of this area are relatively barren of precious metals. Gold values are especially high along the northeast-trending ridge from Summit Spring to the Globe mine (fig. 6, no. 57). At least one company was exploring for large tonnage, low-grade gold deposits in the Globe Canyon-Summit Spring area in 1984.

Common metallic minerals are pyrite and limonite (variable composition of several iron hydroxides) pseudomorphs after pyrite with some galena and secondary copper minerals (chrysocolla, $Cu_2H_2Si_2O_5[OH]_4$; malachite, $Cu_2CO_3[OH]_2$; or azurite, $Cu_3[CO_3]_2[OH]_2$). Mineralized systems are generally exposed for 100 ft or less, but some are as long as 1,500 ft. Propylitic alteration is widespread in the metamorphic rocks, becoming more pervasive and intense in the vicinity of mineralized zones. Sericitic alteration of wall rock is common along quartz veins. Felsic intrusions occur as massive dikes or sills and as irregularly shaped, silica-cemented (collapse?) breccias, but are invariably altered to quartz and sericite. One concentric, pipe-like intrusive body is exposed in the center of sec. 8, T. 11 N., R. 14 E. S.B.M. A nearby outcrop on the SS No. 17 prospect, south (fig. 6, no. 42) contains molybdenite (MoS_2) rosettes along with large pyrite crystals and native sulfur after pyrite in massive, white, radial and

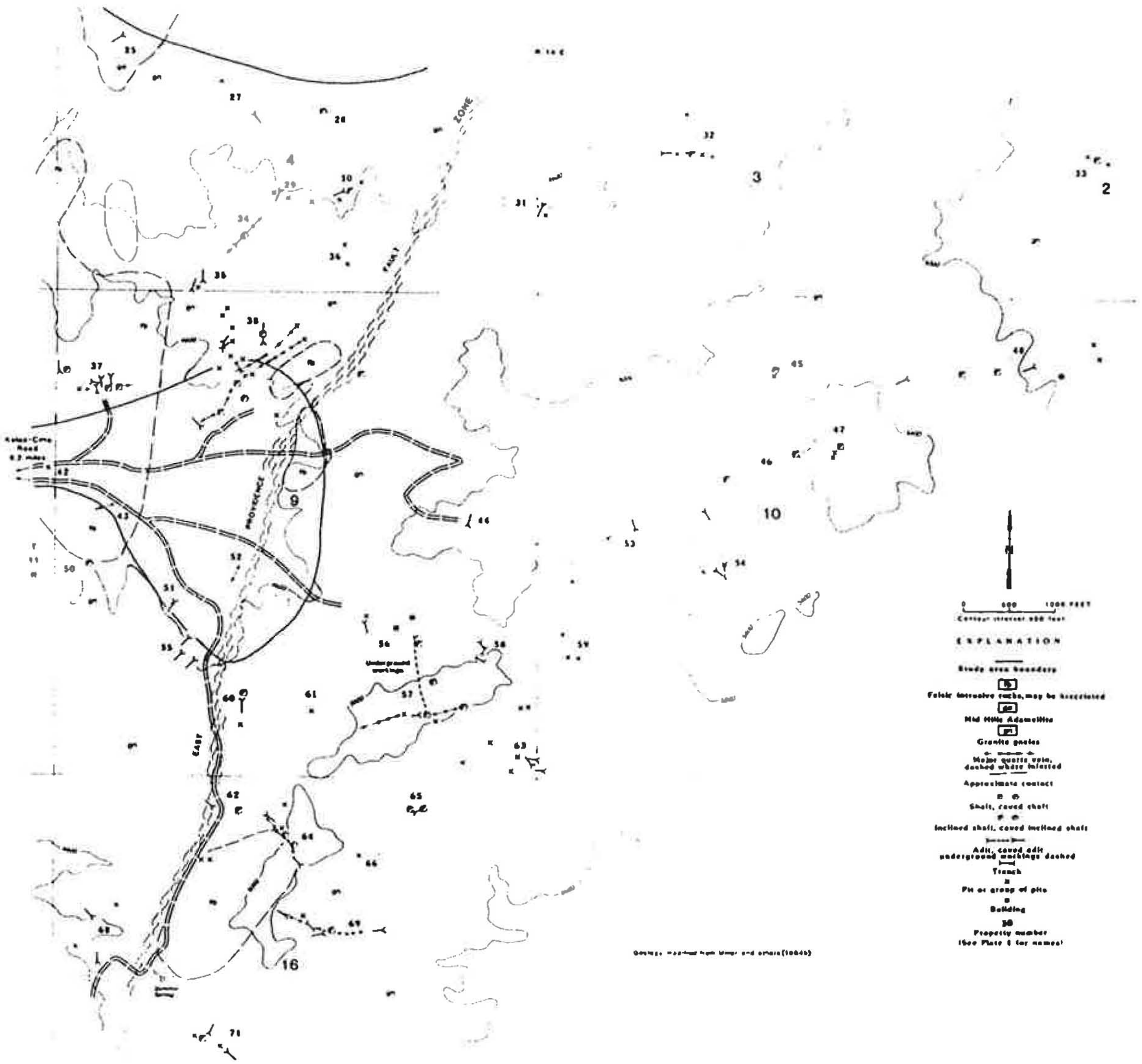


FIGURE 6.—Mines and prospects in the Globe Canyon-Summit Spring area

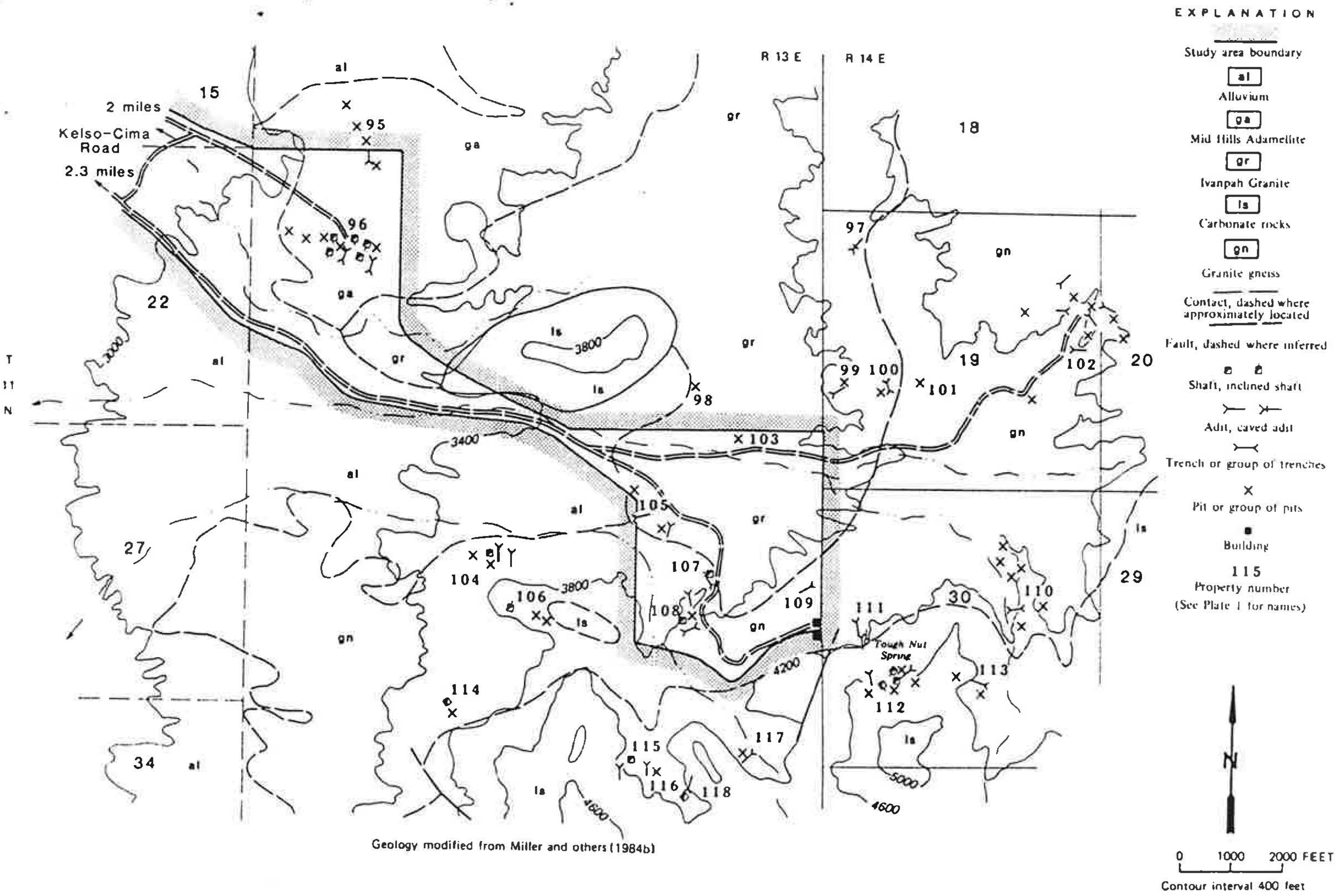
ring quartz dikes surrounding a felsic intrusive breccia. Several companies have explored this prospect area since 1970 based on evidence suggesting a molybdenum stockwork deposit at depth.

The surface expression of the northeast-trending East Providence fault zone in this area is indistinct as opposed to areas where it cuts carbonate rocks. Rocks along both sides of the fault, especially in the hanging wall on the east, are intensely altered and commonly brecciated and silica cemented, as is the ridgeline north of Summit Spring. The East Providence fault obliquely cut the general deformation fabric, as defined by the veins, shears, and secondary faults, and probably acted as the primary conduit for mineralizing solutions. The intersections of the East Providence fault with prominent crosscutting faults may be the loci for the several felsic intrusions which are probably comagmatic (Miller and others, 1984b) with late-stages of the Mid Hills Adamellite.

Gold and silver resources or occurrences are estimated for eight of the properties. An unnamed prospect (fig. 6, no. 31), the Dixie No. 2 prospect, SS No. 28 prospect, north, SS No. 29 prospect, north, SS No. 20-22, 27-29 mine, south (Star [?] mine), Globe mine, Frisco No. 3 mine, and the Double H Nos. 1 and 2 mine (fig. 6, nos. 32, 34, 35, 38, 57, 64, 69, respectively) are described in detail with accompanying maps and tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Tough Nut Spring Area

In the Tough Nut Spring area (fig. 7), 16 of 23 nonferrous metal mines and prospects contain concentrations of gold or silver ± lead, copper, and zinc. Within or on the border of the study area are 8 shafts, 19 adits, 2 trenches and at least 45 pits. Within a corridor excluded from the study area are 7 shafts, 5 adits, 3 trenches and 16 pits. The Jo Je mine (fig. 7, no. 96) produced gold and silver. The Black Jack mine (fig. 7, no. 118) is an iron replacement deposit (see Iron). Mineralized quartz veins, shears, and faults trend east to northeast in Precambrian gneiss and the Jurassic Ivanpah Granite. Two groups of workings are in the Cretaceous Mid Hills Adamellite, and five are in Paleozoic age carbonate rocks in close proximity to the Ivanpah Granite. Mineralized zones in gneiss are generally intensely chloritized and iron-oxide stained; the country rock is weathered. Fracture-filling specularite veinlets are common. Limonite after pyrite, galena, and secondary copper minerals are the most common minerals observed in altered crystalline rocks in this area. A north-northeast-trending set of felsic dikes, commonly aplite and pegmatite, and probably related to the Mid Hills Adamellite, intruded both Precambrian and Jurassic rocks in this area (Miller and others, 1984b) and may have contributed to one or more mineralizing events. An intrusive contact less than 100 ft beneath some areas of apparently gneissic rock is indicated by argillic and sericitic alteration, and brecciated granitic rock with disseminated pyrite found at the L'Chacana prospect (fig. 7, no. 108). In general, silver and gold are widespread in this area, and the silver-to-gold ratio



Geology modified from Miller and others (1984b)

FIGURE 7.— Mines and prospects in the Tough Nut Spring area

is approximately 10:1. Lead is more common than zinc, and copper content is erratic. Anomalous concentrations of molybdenum were detected in several zones, especially ones associated with the Mid Hills Adamellite.

Five carbonate-hosted deposits clustered around the Tough Nut mine contain high-grade silver- and gold-bearing replacement pods and lenses along faults and shears. Minerals consist predominantly of silver halides, lead, and copper carbonates. The mineralized zones at the Tough Nut mine are very similar to those at the Silver King and Bonanza King mines.

No resources are identified; however, a 3,300-ton gold occurrence is estimated at the Green Scorpion prospect (fig. 7, no. 99). The Jo Je mine, Green Scorpion prospect, Fan 1-5 prospect, Pink Jack prospect, Tough Nut mine, and the Lopez No. 3 prospect (fig. 7, nos. 96, 99, 102, 104, and 112) are described in detail with accompanying maps and tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Fountain Peak-Foshay Pass Area

Mineralized zones at 6 of 11 known mines or prospects, which occur along the north side of Foshay Pass (fig. 8), may be related to the intrusive Fountain Peak Rhyolite of Tertiary age (Hazzard, 1954) or older (Miller and others, 1984a, p. 6). In the Foshay Pass area, 5 shafts, 11 adits, 7 trenches, and 5 pits are within the study area and, in addition to the Vulcan mine-Burro prospect developments, 7 trenches, 1 pit and a network of exploration and drill roads are adjacent to the study area. The prospects occur in carbonate rocks commonly within a few hundred feet of the irregular contact with Fountain Peak Rhyolite. Mineralized zones are faults or shears which trend north to northwest and dip vertically or southwesterly roughly parallel to the intrusive contact. Carbonate rocks near these zones are commonly silicified, but may be friable and bleached; yellow or white calcite ($CaCO_3$) veinlets are common. Malachite and azurite occur as blebs in limestone or as encrustations in fracture and alteration zones throughout most of the workings. Minor chalcopyrite, galena, and smithsonite ($ZnCO_3$), possible bornite (Cu_5FeS_4), and traces of cinnabar (HgS) and iodyrite (AgI) were detected in petrographic and microprobe analysis.

Samples from four of the prospects contained gold, and those from two contained significant quantities of silver. Pertinent data on the prospects are listed in appendix B.

East Providence Fault Zone

From the Providence mine 0.5 mi south of Summit Spring, south 3.5 mi to the Bonanza King mine, the East Providence fault zone cuts and juxtaposes carbonate rocks against sheared metamorphic and plutonic rocks. In this area, 2 shafts, 2 adits, and 3 pits are within the study area; and 6 shafts, 16 adits, 1 tunnel, 17 trenches, and 23 pits are adjacent to the study area. The Providence, Silver King, and Bonanza

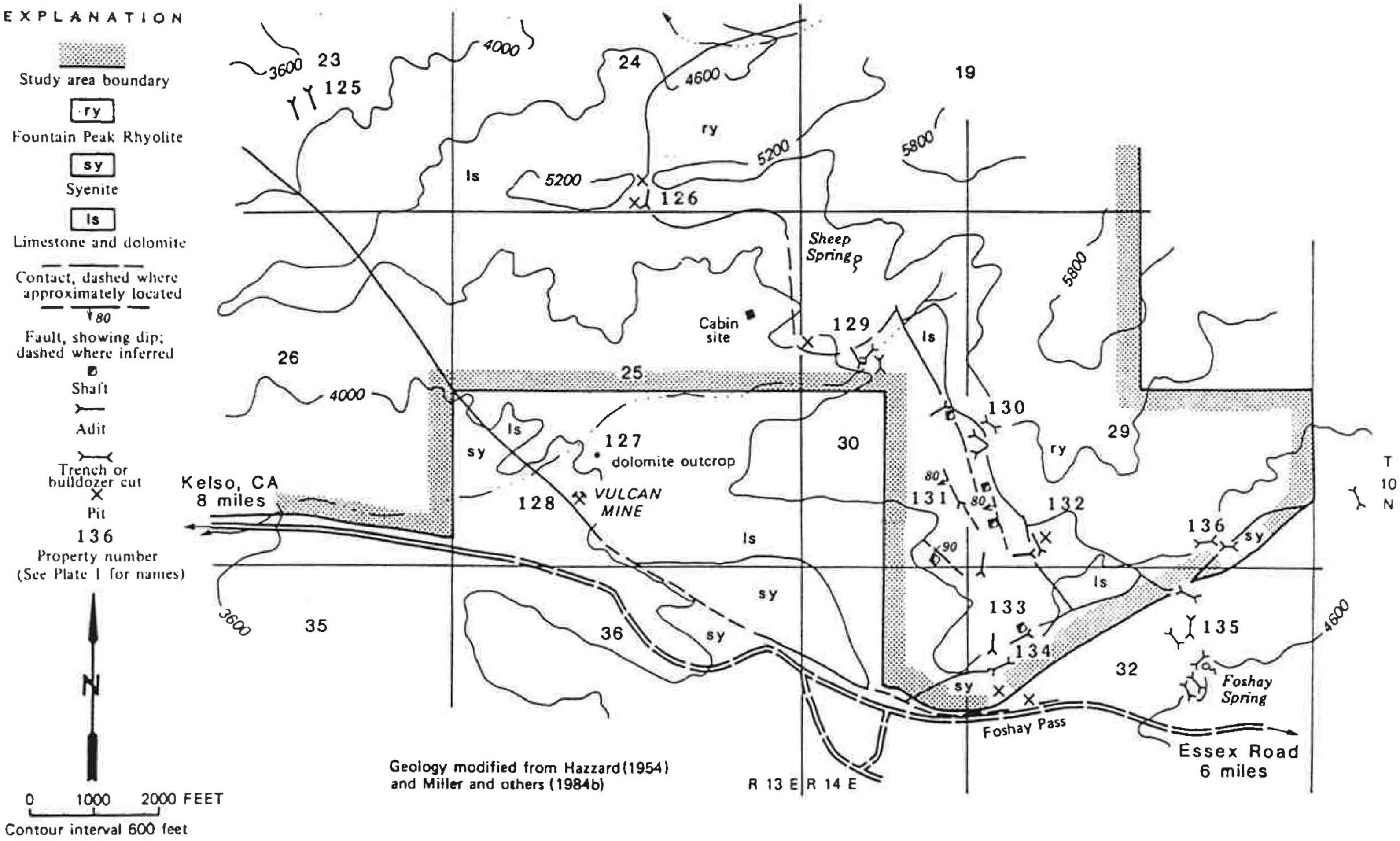


FIGURE 8.— Mines and prospects in the Fountain Peak-Foshay Pass Area

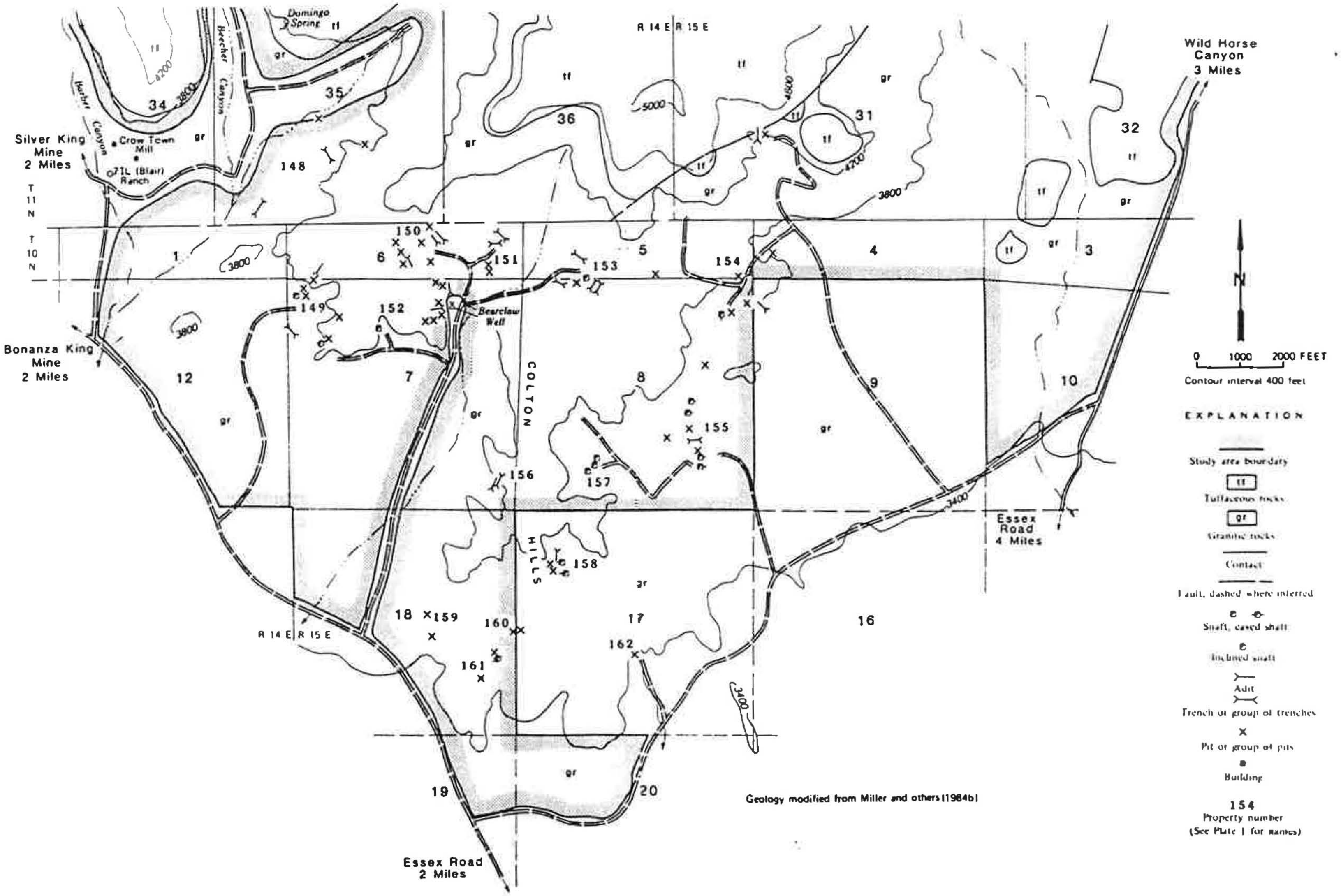
King mines are on carbonate-hosted deposits along this segment of the fault and are past producers of silver, lead, and copper ± gold and zinc. The deposits are replacements or cavity fillings in deformed, finely brecciated, carbonate rocks. Breccia zones are cemented with earthy iron oxides plus calcite and/or silica. Mineralized zones are subparallel to the East Providence fault at the Providence mine, in cross breaks (tension fractures) at the Bonanza King mine, and along splinter faults at the Silver King mine. Although minor amounts of galena, sphalerite, and pyrite are visible, most of the metallic minerals occur as carbonates such as cerussite ($PbCO_3$) and smithsonite, oxides such as hematite, or salts, such as cerargyrite (AgCl) or bromyrite (AgBr). Other deposits in the study area that are in carbonate rocks, such as the SS No. 63, 64 prospect near the Providence mine, the Tough Nut mine, and the nearby Lopez Nos. 1 and 3 prospects, have similar mineral assemblages and structural control. Minor occurrences east of the fault, such as the gold-bearing prospect at no. 138 (plate 1), occur in sheared and altered gneissic rocks and are not similar to the carbonate-hosted deposits.

No carbonate-hosted resources are identified along the East Providence fault zone; however, the Bonanza King mine dump is estimated to contain 19,000 tons of inferred silver resources. The Providence, Silver King, and Bonanza King mines are described in detail with accompanying maps and sample tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Colton Hills Area

In the northern Colton Hills area, 9 of 15 properties contain concentrations of gold, silver, lead, copper, iron, and barium (fig. 9). Thirteen shafts, 8 adits, 13 trenches, and 42 pits are within the study area, and 2 shafts, 2 adits, and 7 pits are adjacent to the study area. All of the workings are on veins, shears, or fault zones in granitic rock of probable Jurassic (Miller and others, 1984b) age. Most of the structures are small, localized, and randomly oriented; three are prominent, significantly mineralized deposits. The Grande 1-7 mine (fig. 9, no. 150) is developed on a northwest-trending, northeast-dipping, 400-ft-long quartz-bearing shear zone with significant gold and silver values. The Max Dor 1 and 2 mine (fig. 9, no. 153) contains about 2,600 ft of quartz veins, which strike east and dip to the north, and a 300-ft fault which trends northwest and dips northeast. The Gold Star prospects (fig. 9, nos. 154 and 155) to the east have randomly oriented, mineralized veins and shears which occur within a northeast-trending, intensely altered zone 60 to 400 ft wide and as much as 1.5 mi long. McCurry's map (1982, fig. 1) of Wild Horse Mesa, Woods and Hackberry Mountains, and the pattern of significant precious- metal-bearing deposits around the mesa suggest the ring of a caldera.

A weak zoning is evident among the base metals; lead is the dominant accessory metal to the west and copper to the east. The BC prospect (fig. 9, no. 148) may be associated with a large, buried iron deposit.



Geology modified from Miller and others (1984b)

FIGURE 9.— Mines and prospects in the Colton Hills area

The Grande 1-7 and Max Dor 1 and 2 mines and the two Gold Star properties (fig. 9, nos. 150, 152-155) are described in detail with accompanying maps and tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Other Areas

Of 23 remaining precious- and base-metal properties within and adjacent to the study area, most (plate 1, nos. 26, 39-41, 67, 73, 74, 76, 77, 79-86, 88, 93) are situated in the west Globe Canyon-Summit Wash area. Two lie in excluded corridors of the southwest portion of the study area (plate 1, nos. 120, 122), and two lie in the Barber Canyon area (plate 1, nos. 138, 139). Collectively, these 23 properties contain 27 shafts, 17 adits, 7 trenches, and 38 pits within or on the border of the study area, and 3 shafts, 2 adits, 3 trenches, and 4 pits within exclusions from the study area.

The Okaw mine (plate 1, no. 77) is a probable past producer, and the Rex mine (plate 1, no.122) is a known past producer of gold and silver. Mineralized zones at the Okaw mine are generally prominent, northeast-trending quartz veins in relatively fresh granitic rock which is intruded by thick, rhyolite dikes. All rocks exhibit sericitic alteration, and limonite after pyrite, galena, minor chalcopyrite, sphalerite, and secondary copper minerals were observed. Veins at the Silver Queen I-XXXIII prospect (plate 1, no. 93), although less prominent, are very similar in character to those at the Okaw mine. The ore minerals at the Rex mine are in an intensely oxidized zone of massive to brecciated quartz, Jurassic granitic rock, and earthy iron oxides which is parallel to and lies along the probable northern projection of the Hidden Hill fault of Miller and others (1984a). A prominent, quartz-filled shear and gouge zone cuts Precambrian gneiss at the Good Hope mine (plate 1, no. 139). Most of the prospects developed on structures in Precambrian gneiss in the lower Summit Wash area carry anomalous, but not economically significant, concentrations of precious and base metals.

A small occurrence of gold is estimated at the Rex mine, and a gold resource is identified at the Good Hope mine. The Okaw, Rex, and Good Hope mines are described in detail with accompanying maps and sample tables in appendix A; pertinent data on all of the mines and prospects are listed in appendix B.

Placer Gold Occurrences

Minor quantities of gold occur in the alluvium of several washes which drain the Providence Mountains. San Bernardino County and BLM records show nearly 50 historic and actively held placer mining claims within and adjacent to the study area (fig. 10). The earliest claim location was the Firefly in 1913 in Summit Wash and the largest claim groups, the Kelso and Bonanza placers, were located in the late-1970's on drainages and alluvial fans from the Cornfield Spring and Foshay Pass areas. The large claim groups were dropped due to lack of high-grade

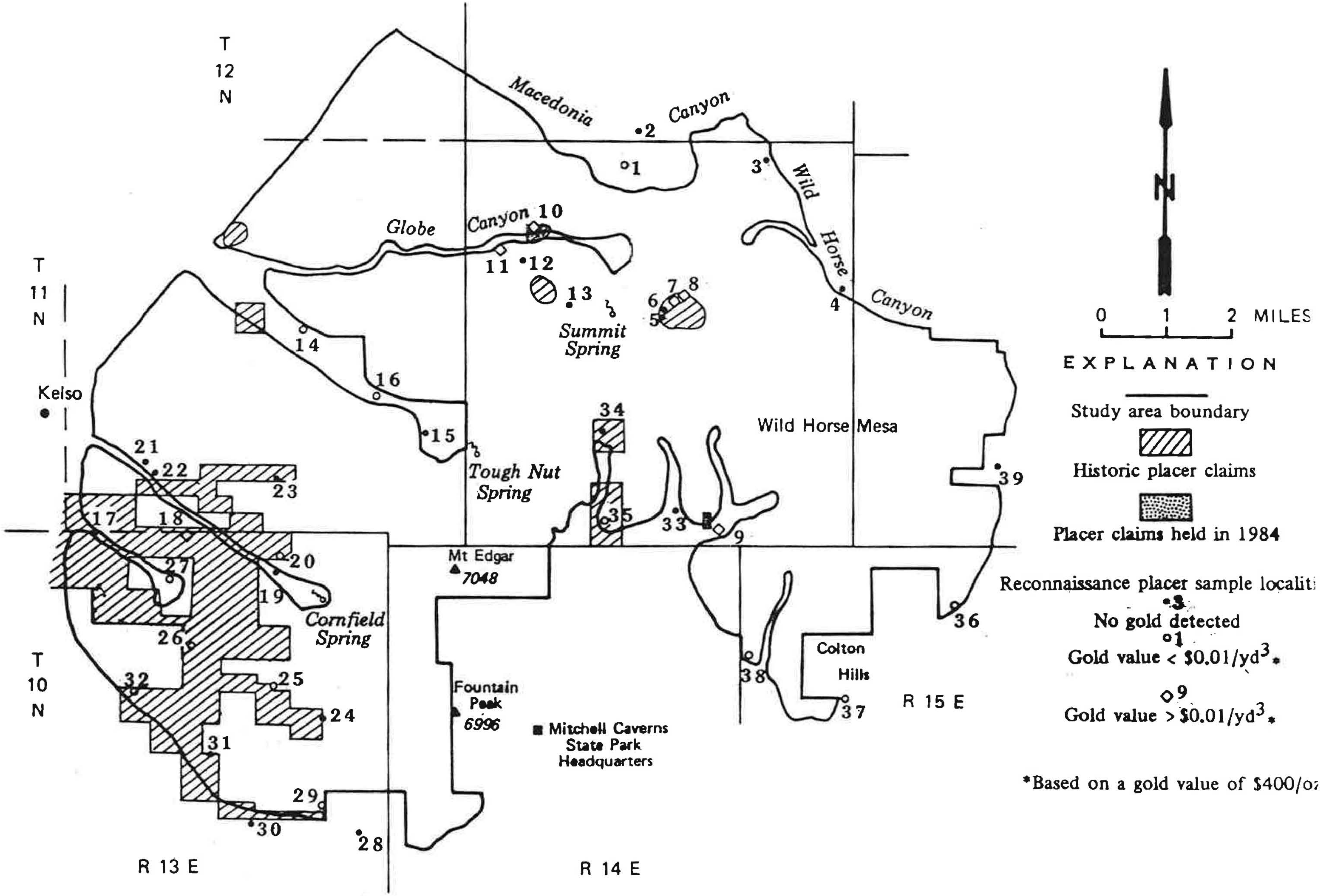


FIGURE 10. – Placer claims and sample localities

samples. Two placer claims, the Silver Star placer on mill tailings from the Bonanza King Mine in sec. 34, T. 11 N., R. 14 E. S.B.M., and the Terry placer prospect (plate 1, no. 75) on Globe Wash in sec. 7, T. 11 N., R. 14 E. S.B.M. were actively held in 1982-1984.

Of 39 alluvial samples from washes within and adjacent to the study area, 19 contained detectable gold (fig. 10; table 4). The gold is commonly very fine-grained, bright, and subrounded to subangular. Only six contained sufficient gold to exceed a value of $0.01/yd^3 (dollar per cubic yard) 4/; the highest was $0.15/yd^3. Generally, the placer gold is in alluvium derived from known mineralized areas. For example, the higher-grade samples were from washes which drain Beecher Canyon, Globe Canyon, and Summit Spring (plate 1, nos. 70, 75 and 87); these are areas with a high density of gold-bearing lode deposits.

Seven placer samples from the Cornfield Spring-Foshay Pass area contained gold. Although gold from two may have come from the Rex mine deposit, five are from washes which drain areas without known gold deposits. The source of the gold could be either the Fountain Peak Rhyolite contact zone or the northwest-trending Hidden Hill fault identified by Miller and others (1984a) as related to precious-metal occurrences in the south Providence Mountains and iron at the Vulcan mine-Burro prospect.

Iron

Three significant iron deposits, the Black Jack and Cornfield Springs Consolidated mines and the Vulcan mine-Burro prospect (plate 1, nos. 118, 121, and 128), and at least two iron prospects (plate 1, nos. 134 and 148), occur within or adjacent to the study area. Other prospects in the area (plate 1, nos. 125 and 149) also contain concentrations of iron. The largest iron deposits in the region occur in carbonate rocks and all known or suspected deposits are near granitic rocks of Jurassic (Miller and others, 1984b) age. Most are within aeromagnetic anomalies ranging from 100 to 2,000 gammas (U.S. Geological Survey, 1981).

The Vulcan mine-Burro prospect is on a magnetite-bearing (Fe_3O_4), magnesium silicate skarn along a fault-controlled contact between syenite to quartz monzonite on the south and magnesium-rich carbonate rocks on the north. The Black Jack and Cornfield Spring iron mines also are in carbonate rocks, but they are 100 to 400 ft stratigraphically above a contact with plutonic or metaplutonic rocks, and are predominantly composed of specularite. The three mines are described in detail in appendix A.

Limestone and Dolomite

Limestone and dolomite units of possible economic significance in the Providence Mountains (Gray and Bowen, 1980, p. 154) lie within a

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4/ Based on a gold value of $400/oz.

TABLE 4.--Placer samples taken in the Providence Mountains study area

(N, none detected; NA, not applicable)

Sample no. (fig. 10)	Name of property/drainage	Map no. (plate 1)	Gold recovered 1/ (milligrams)	Value 2/ ($/yd^3)	Remarks
1	Macedonia Canyon alluvium	NA	0.002	<0.01	NA
2	do	NA	N	NA	Trace native copper
3	Doodle Bug-Wild Cat-Wild Horse placer prospect	49	N	NA	do
4	do	49	N	NA	NA
5	Santa Anita-Beecher Canyon placer prospect	70	N	NA	Trace scheelite
6	do	70	N	NA	do
7	do	70	.023	.02	Trace scheelite and pyrite
8	do	70	.022	.02	do
9	do	70	.169	.15	Select sample of surface black sands
10	Terry placer	75	.020	.02	do
11	Firefly-White Eagle-Star placer prospects	87	.110	.10	Trace hematite

TABLE 4.--Placer samples taken in the Providence Mountains study area--Continued

Sample no. (fig. 10)	Name of property/drainage	Map no. (plate 1)	Gold recovered 1/ (milligrams)	Value 2/ ($/yd^3)	Remarks
12	Firefly-White Eagle-Star placer prospects	87	N	NA	Trace scheelite
13	do	87	N	NA	do
14	First Chance placer prospect.	94	0.001	<0.01	NA
15	Tough Nut Spring-Hayden alluvium	NA	N	NA	Trace cinnabar
16	do	NA	.006	< .01	NA
17	Kelso placer prospects, north	119	N	NA	Trace scheelite
18	do	119	.068	.06	do
19	do	119	N	NA	NA
20	do	119	.002	<.01	Trace hematite
21	do	119	N	NA	NA
22	do	119	N	NA	NA
23	do	119	N	NA	Trace scheelite
24	Kelso placer prospects, south	123	N	NA	do
25	do	123	.006	<.01	do
26	do	123	.001	<.01	NA

TABLE 4.--Placer samples taken in the Providence Mountains study area--Continued

Sample no. (fig. 10)	Name of property/drainage	Map no. (plate 1)	Gold recovered 1/ (milligrams)	Value 2/ ($/yd^3)	Remarks
27	Kelso placer prospects, south	123	0.006	<0.01	NA
28	Bonanza 1-8 placer prospects	124	N	NA	NA
29	do	124	.003	<.01	NA
30	do	124	N	NA	Trace scheelite
31	do	124	N	NA	Trace hematite
32	do	124	.004	<.01	NA
33	Sunny Boy Extension placer prospects	142	N	NA	NA
34	do	142	N	NA	NA
35	Silver Queen-Golden Horse placer prospects	145	.008	<.01	NA
36	Colton Hills alluvium	NA	.005	<.01	NA
37	do	NA	.003	<.01	NA
38	do	NA	.008	<.01	NA
39	Unnamed drainage	NA	N	NA	Trace native copper

1/ Sample volume 0.38 ft^3 (cubic foot) for each sample.
2/ Based on a gold value of $400/oz.

10,000-ft-thick Paleozoic section (Hazzard, 1954) of predominantly carbonate rocks in the south-central part of the study area (fig. 11). The Paleozoic section is intensely faulted and individual lithologic units cannot be traced for long distances. Limestone units include the Anchor member (100-150 ft), the Bullion member (250-350 ft) and part of the Yellowpine member (75-125 ft) of the Mississippian Monte Cristo Limestone, the Crystal Pass (250-300 ft) and upper Valentine (350-400 ft) limestone members of the Devonian Sultan Limestone, and the Early Cambrian Chambless Limestone (170-220 ft) (Hazzard, 1954, table 1). Limestone may also occur in marine portions of the Triassic Moenkopi Formation (approximately 500 ft thick) (Gray and Bowen, 1980, p. 154). Dolomitic rock units include portions of the Middle Cambrian Bonanza King Formation (1875-2230 ft), the lower part of the Late Cambrian Cornfield Springs Formation (650 ft), and the Ironside Dolomite member of the Middle Devonian Sultan Limestone (50-75 ft) (Hazzard, 1954, table 1). Bowen and others (1973, plate 1) identified three localities with large (20 million tons or more) undeveloped limestone and/or dolomite units in the Providence Mountains: Tough Nut Spring vicinity, Bonanza King Canyon, and Vulcan mine-Burro prospect (plate 1, no. 128) vicinity.

Eighteen random chip samples were taken at accessible sites in limestone- and dolomite-bearing formations. The number and size of samples were limited by the remoteness and difficultly of access to many of the favorable sites. The sample localities and approximate distribution of carbonate-bearing lithologic units are shown on figure 11, and analytical results are listed in table 5.

Of eight samples (L-1 to L-8) of limestone at four sites, $CaCO_3$ ranged from 91.6 percent to 95.5 percent in 6 samples; the others contained 85.7 percent and 89.4 percent. Four of the samples contained greater than 1 percent SiO_2.

Two samples of dolomite (D-1 and D-2) from the Cornfield Spring Formation near Bonanza King Canyon averaged 19.4 percent MgO and contained levels of Fe_2O_3, Al_2O_3, and SiO_2 which are acceptable for many uses. Eight samples (D-3 to D-10) were taken from a dolomite unit near the Vulcan mine-Burro prospect. Magnesia values from the samples ranged from 15.0 percent to 21.4 percent and averaged 19.1 percent exclusive of sample D-3 which had 5.4 percent MgO. Several of these samples contained high SiO_2 and Fe_2O_3 values. The deposit was examined by Charles Deiss (1943) when the then Vulcan (iron) mine was operating. The dolomite occurs as a north-northeast-trending ridge approximately 2,000 ft long and over 1,000 ft wide at its base and contains an estimated 12 million tons of dolomite. The deposit is part of the lower dolomite member of the Middle Cambrian Bonanza King Formation (Hazzard, 1954, plate 2).

Silica

Prospect Mountain Quartzite

Ver Planck (1966) suggested quartzite-bearing rock units in the Providence Mountains may contain resources suitable for industrial applications. The Lower Cambrian Prospect Mountain Quartzite is exposed at the base of the

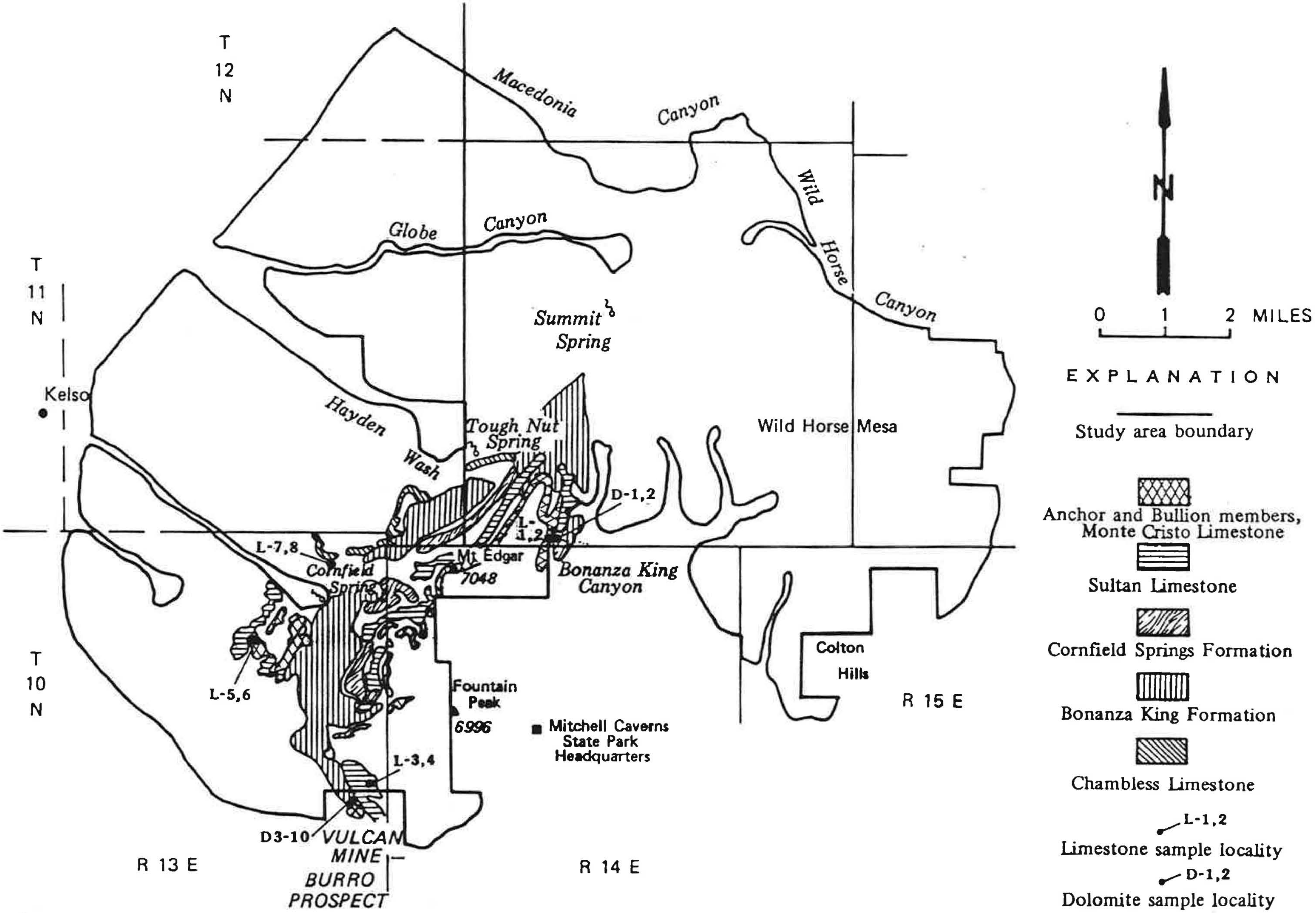

FIGURE 11. – Distribution of principal formations with carbonate units

Geology modified from Hazzard (1954)

TABLE 5.--Limestone and dolomite samples taken in the Providence Mountains study area

[N, none detected; --, not analyzed]

(Analyses are in percent)

Sample no. (fig. 11)	Type	Description	CaCO$_3$ 1/	CaO	MgO	Fe$_2$O$_3$	Al$_2$O$_3$	SiO$_2$	MnO	K$_2$O	Na$_2$O	TiO$_2$	SO$_4$	LOI 2/ (1,000°C)
		Limestone samples												
L-1	Random chip.	Medium-gray, subcrystalline limestone with calcite stringers (Bullion member, Monte Cristo Limestone)-----	94.8	53.1	0.28	0.061	0.36	0.57	0.019	N	0.056	N	0.23	39.94
L-2	do----	do----------------------------------	93.9	52.6	.73	.11	.49	1.2	.064	N	.040	0.0029	.19	41.80
L-3	do----	Medium-gray, fine-grained limestone with calcite stringers (Sultan Limestone near rhyolite contact)----	85.7	48.0	.92	.54	.73	9.3	.11	N	N	.026	.18	38.95
L-4	do----	Aphanic dark gray limestone with calcite stringers and minor iron-oxide staining (Sultan Limestone)---	95.5	53.5	.66	.079	.45	.22	.013	N	.051	.0042	.14	42.58
L-5	do----	Medium-gray, fine-grained limestone with sparse calcite (Bullion member, Monte Cristo Limestone)-----	94.6	53.0	.56	.13	.49	1.6	.021	N	.052	.0081	.19	41.59
L-6	do----	Dirty-gray limestone with pods of iron oxide and stringers of calcite (Bullion member, Monte Cristo Limestone)------------------------	92.8	52.0	.43	.33	.56	1.9	.18	0.059	.059	.0092	.28	40.96
L-7	do----	Dark-gray-to-black limestone with clasts of limestone up to 1/2 in. diameter (Chambless Limestone)------	89.4	50.1	2.4	.27	.80	.99	.016	N	.055	.017	.20	42.56
L-8	do----	do----------------------------------	91.6	51.3	1.6	.25	.81	.88	.021	N	.045	.014	.23	42.40
		Dolomite samples												
D-1	do-----	Light-gray, subcrystalline dolomite (Cornfield Springs Formation)-------	55.5	31.1	19.5	.28	.51	.022	.04	.064	.2	.003	.20	44.96
D-2	do----	Dark-gray dolomitic limestone with iron-oxide pockets and calcite veins (Cornfield Springs Formation)-------	60.2	33.7	19.3	.23	.46	.012	.017	N	N	.0037	.14	44.65

TABLE 5.--Limestone and dolomite samples taken in the Providence Mountains study area--Continued

Sample no. (fig. 11)	Type	Description	$CaCO_3$ 1/	CaO	MgO	Fe_2O_3	Al_2O_3	SiO_2	MnO	K_2O	Na_2O	TiO_2	SO_4	LOI 2/ (1,000°C)
Dolomite samples--Continued														
D-3	Random chip.	Massive, fine-grained, crystalline, gray dolomitic limestone with fetid odor; weathers to tan or buff (lower dolomite member of the Bonanza King Formation)-------------	80.3	45.0	5.4	0.37	0.13	2.3	.19	N	N	0.0051	0.02	43.00
D-4	do----	Light-tan to mottled-gray, slightly fractured dolomite with iron oxide on fractures and a fetid odor (Bonanza King Formation)------------	56.4	31.6	21.4	.18	.093	.39	.04	0.12	0.028	.0055	.04	46.35
D-5	do----	Dark-gray to black dolomite with minor iron-oxide staining (Bonanza King Formation)------------	56.6	31.7	21.4	.24	.19	1.5	.026	N	.019	.016	.04	45.57
D-6	do----	Medium to dark-gray dolomite with calcite stringers (Bonanza King Formation)--------------------------	54.3	30.4	20.4	.32	.24	1.8	.05	N	N	.018	.03	45.19
D-7	do----	Dark-brown to bleached-white dolomite speckled with iron oxide; bleached zones are punky (Bonanza King Formation)--------------------------	57.1	32.0	19.2	.45	.60	3.8	.062	N	N	.04	.03	43.46
D-8	do----	Fine- to medium-grained, white to dark-gray, dolomitic limestone with minor iron-oxide stain (Bonanza King Formation)---------------------	57.1	32.0	17.8	.56	.35	2.3	.093	N	.026	.033	.15	45.04
D-9	do----	Massive to brecciated, buff to gray dolomitic limestone with some epidote along fault zone (Bonanza King Formation)------------	61.4	34.4	15.0	1.1	.61	5.2	.11	N	N	.041	.10	42.89
3/ D-10	do----	do----------------------------------	59.3	33.2	18.2	.90	.57	2.6	.12	.13	.023	.04	.04	44.09

1/ $CaCO_3\% = \frac{CaO\%\ (100.09)}{(56.08)}$

2/ Loss on ignition.

3/ Also contains 0.092% P_2O_5.

Paleozoic section on the western side of the study area. Ver Planck (1966, p. 29) described the nature and distribution of this formation in southeastern California and noted:

> It is heterogeneous and in many places contains, in addition to quartzite, shale, slate, carbonate rock, sandstone, and conglomerate. The quartzite parts are likely to be thin bedded and cross bedded. Conglomerate lenses composed of quartz and chert pebbles are characteristic, especially near the base.

Furthermore, Ver Planck (1966) described the Tough Nut Spring locality as one of several with a 50-100 ft section of vitreous quartzite in local mountain ranges. Locally, the Prospect Mountain Quartzite section is several hundred feet thick and crops out for approximately 3 mi. Beds strike to the east-northeast and dip 20°-40° SE. The outcrops are buff, orange, or red, and the rock may have a banded appearance due to cross bedding or to sorting by grain size or density. Petrographic analyses of samples taken during this field study and from Ver Planck (1966) report a fine- to coarse-grained (as much as 1/4 in. [inch]) quartzite of widely diverse grain size with a minor sericite matrix and several percent combined iron oxides (limonite, hematite, and magnetite) which occur as grains and veinlets and along seams. Quartz grains are brecciated and recrystallized. Chlorite is associated with opaque minerals.

Three samples of Prospect Mountain Quartzite were taken by the USBM. Two samples taken from the lower adit at the Tough Nut mine (plate 1, no. 112) contained 54.7 and 68.6 percent SiO_2, 22.2 and 13.5 percent Al_2O_3, 6.5 and 5.8 percent Fe_2O_3, 0.85 and 0.57 percent TiO_2, 0.98 and 1.8 percent CaO, 2.5 and 0.97 percent MgO, and 0.13 and 0.043 percent Na_2O, and had ignition losses of 5.22 and 4.29 percent. Field evidence indicates the samples are from a zone affected by hydrothermal alteration. The third sample, taken from a slightly iron-oxide stained outcrop of recrystallized pebble conglomerate, contained 94.0 percent SiO_2, 2.5 percent Al_2O_3, 2.3 percent Fe_2O_3, 0.064 percent TiO_2, 0.08 percent CaO, and 0.031 percent MgO, and had an ignition loss of 0.93 percent.

Quartz Prospects

One small prospect (plate 1, no. 78) is on three segments (52-, 72-, and 180-ft long) of a 6- to 10-ft-thick, white quartz vein. The vein trends northwest, crops out over a strike length of 440 ft, and is estimated to contain approximately 9,900 tons of quartz. One grab sample contained 99.15 percent SiO_2, 0.30 percent Fe (iron), and 0.05 percent Al_2O_3; no gold or silver was detected. The Globe and Macedonia Canyon areas contain numerous quartz veins, but these are commonly iron-oxide stained and mineralized with sulfides.

Rock Products

Two quarries in the Providence Mountains are known to have produced building or decorative stone. One is a small quarry in the Hole-in-the-Wall Tuff (McCurry, 1980a) in the N1/2 sec. 11, T. 11 N., R. 14 E., S.B.M., within the study area (plate 1, no. 48); it has a network of bulldozer trails. The buff to gray, punky to silicified tuff is relatively flat-lying and is interbedded with rhyolite, andesite, and basalt flows. The desired stone was quarried by splitting the rock, along parting planes, into a product 2 to 5 in. thick and 12 in. or more in diameter. There is no record of production, but a maximum of 10 to 20 tons of stone were probably removed. It is marginally suitable as wall or fireplace veneer and, based on unpublished comparative decorative stone market studies in the western United States, wholesale price (delivered) would probably be $50/ton (dollar per ton) or less.

The second quarry, in welded, rhyolitic tuff, was developed in the early 1880's as a source of dimension stone for buildings in the town of Providence. It is located adjacent to the Bonanza King mine in the center of sec. 3, T. 10 N., R. 14 E., S.B.M., and lies approximately 1/2 mi outside of the study area (plate 1, no. 147). There is no record of production, but several hundred tons of roughly equidimensional rubble were probably quarried prior to 1890. Stone from this or a nearby site was used to construct foundations for the original Bonanza King and Silver King mills. In the early 1940's (Dudley and Fickewirth, 1941, p. 22-23), the original buildings of the town of Providence were largely intact.

Voluminous deposits of common borrow, sand, and gravel are in the study area. Most of these deposits are in the Quaternary alluvium at lower elevations. Large deposits of limestone and dolomite contained in the study area may be suitable for the common aggregate uses; however, the major consumption areas are distant.

Petrified Wood

Small amounts of petrified wood occur as float on the surface and at the base of volcanic ash beds near Barber Canyon and Whiskey and Domingo Springs at the mouth of Beecher Canyon (plate 1, no. 143). A small open cut was dug by collectors in the ash beds east of Whiskey Spring (Howard Blair, personal commun., 1982). A maximum of 2 to 3 yd^3 (cubic yards) of float are exposed at Barber Well. Strong (1966, p. 62) described the original source as *Sequoia landsdorffia*. The petrified wood occurs as rubble up to 6 in. in diameter. It is agatized, non-fractured, and ranges from light tan to nearly black. Cut specimens show a distinct wood grain pattern in light brown tones. Specimens were submitted for evaluation to two rock and gem dealers in Spokane, WA. The dealers quoted raw product wholesale prices ranging from $0.10 to $0.25/lb (dollar per pound) and a retail raw product price of about $1.00/lb. One dealer classed the specimens as excellent for jewelry due to the grain pattern and the competency of the rock. Finished products, such as belt buckle mounts, retail for $2 to $4 for small pieces. Cut and polished rounds (root, limb or log sections) 6 to 12 in. in diameter retail for as much as $50. Both dealers considered the petrified wood as most likely to attract recreational "miners" (rockhounds).

APPRAISAL OF MINERAL RESOURCES

All of the identified precious- and base-metal resources at mines in the study area are currently subeconomic at gold and silver prices of $400/troy oz and $10/troy oz, respectively. All of the deposits occur as 2- to 6-ft-thick veins and shear zones that dip moderately to steeply and would have to be mined by relatively high-cost open or shrinkage stope underground methods. Therefore, the production costs at individual mines would exceed the value of the recovered commodities, including any byproduct base metals. Table 6 lists the tonnage and grade of identified resources and occurrences in and near the study area.

The most promising scenario involves a consolidated mine plan for eight properties in the Macedonia Canyon-Globe Canyon area. Seven of the properties, including an unidentified prospect, the Dixie No. 2 prospect, SS No. 28 prospect, north, SS No. 29 prospect, north, and the Globe, Frisco No. 3, and the Double H Nos. 1 and 2 mines (plate 1, nos. 31, 32, 34, 35, 57, 64, and 69, respectively), contain cumulative identified gold-silver resources of approximately 270,000 tons (table 6). All are within approximately 1 mi of the confluence of the Globe Wash headwaters in W1/2 sec. 9, T. 11 N., R. 14 E. S.B.M., a good location for an on-site mill. Although a greater distance from the centralized location, the addition of the Good Hope mine, 2.5 mi away, would bring the cumulative resources to approximately 310,000 tons. Estimated current metal values average about $25/ton. Other isolated deposits might be considered as possible sources of additional mill feed. Greater total mill feed generally results in lower unit milling cost. Mining costs and on-site heap-leach milling costs would total approximately $70/ton (appendix C). Although the combined estimated value of the eight deposits (about $25/ton) is considerably lower than the estimated production cost for a consolidated plan ($70/ton), a threefold increase in precious-metal values and/or the discovery of higher grades could permit a profitable operation.

Some of the deposits with identified resources, such as the Good Hope mine (plate 1, no. 139), or occurrences such as the Rex mine (plate 1, no. 122) or the Green Scorpion prospect (plate 1, no. 99), are relatively isolated from other promising deposits. Such geographic isolation may inhibit development due to lack of sufficient tonnage for an adequate mine life. For example, although the Good Hope mine contains about 36,000 tons of resources valued 5/ at about $15/ton, the estimated

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5/ Based on a gold value of $400/oz and a silver value of $10/oz.

TABLE 6.--Identified mineral resources and occurrences in the Providence Mountains study area

[*, outside study area; **, partly outside study area]

Map no. (plate 1)	Property name	Quantity (tons)	Resource classification	Weighted average oz/ton	Weighted average percent	Commodity
			Precious and base metals			
10	Silver Buddy mine	1,300	Occurrence	3.3		Silver
					1.24	Lead
23*	Castor-Pollux mine (Columbia mine, Macedonia mine)	5,600	Indicated subeconomic resources	.05		Gold
				9.1		Silver
		18,000	Inferred subeconomic resources	.05		Gold
				9.1		Silver
31	Prospect	35,000	Inferred subeconomic resources	.04		Gold
				.6		Silver
32	Dixie No. 2 prospect	17,000	Inferred subeconomic resources	.01		Gold
				1.0		Silver
34	SS No. 28 prospect, north	10,000	Inferred subeconomic resources	.02		Gold
				.9		Silver
35	SS No. 29 prospect, north	3,000	Indicated subeconomic resources	.05		Gold
				1.7		Silver
		12,000	Inferred subeconomic resources	.05		Gold
				1.7		Silver
44	Hoot Owl prospect	500	Occurrence	.32		Gold

TABLE 6.--Identified mineral resources and occurrences in the Providence Mountains study area--Continued

Map no. (plate 1)	Property name	Quantity (tons)	Resource classification 1/	Weighted average		Commodity
				oz/ton	percent	
			Precious and base metals--Continued			
57	Globe mine	30,000	Indicated subeconomic resources	0.05 1.0		Gold Silver
		80,000	Inferred subeconomic resources	.05 1.0		Gold Silver
64	Frisco No. 3 mine	2,000	Indicated subeconomic resources	.006 .2		Gold Silver
		38,000	Inferred subeconomic resources	.022 .7		Gold Silver
69	Double H Nos. 1 and 2 mine	45,000	Inferred subeconomic resources	.02 2.5		Gold Silver
99	Green Scorpion prospect	3,300	Occurrence	.086		Gold
122**	Rex mine	3,700	Occurrence	.22		Gold
139	Good Hope mine	4,400	Indicated subeconomic resources	.070		Gold
		32,000	Inferred subeconomic resources	.031		Gold
146*	Bonanza King mine	19,000 2/	Inferred subeconomic resources	4.1		Silver
			Ferrous and industrial mineral deposits			
78	Prospect	9,900	Occurrence		99.15	Silica
118	Black Jack mine	230,000 3/	Indicated subeconomic resources		55-60	Iron

TABLE 6.--Identified mineral resources and occurrences in the Providence Mountains study area--Continued

Map no. (plate 1)	Property name	Quantity (tons)	Resource classification 1/	Weighted average		Commodity
				oz/ton	percent	
			Ferrous and industrial mineral deposits--Continued			
121**	Cornfield Springs Consolidated mine	110,000 3/	Inferred subeconomic resources		50	Iron
127**	Dolomite outcrop	12 million	Occurrence		19.1	Magnesia
128*	Vulcan mine-Burro prospect	3.0 million 3/	Inferred subeconomic resources		50	Iron

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1/ U.S. Bureau of Mines and U.S. Geological Survey, 1980.
2/ From dumps
3/ Long tons

mining, milling, and recovery (heap leach) costs would be about $150 to 160/ton (appendix C). Total mining and milling costs, if shipped to the custom mill at Ivanpah, CA, would be about $160 to 170/ton.

The number of workings, the past production, and the character of identified deposits in the study area will continue to attract claim locations, prospecting, and at least moderate surface disturbance in the foreseeable future. The Summit Spring, Globe Canyon, upper Beecher Canyon, and Macedonia Canyon areas are especially attractive to both small scale prospecting and major exploration by private industry.

Exploration for large-tonnage/low-grade deposits was being conducted in the Summit Spring-Globe Canyon area during 1984. A large-tonnage deposit would be amenable to open-pit mining methods at a much lower cost (appendix C, table C-2). Deposits as large as about 5 to 15 million tons of ore can be economically mined at grades as low as 0.02 oz/ton gold with 2 to 3 oz/ton silver (Ivosevic, 1984, p. 11-13).

The known placer gold occurrences in the study area are not considered to be economically significant. However, small, scattered, high-grade concentrations may occur in alluvium derived from areas of lode gold deposits. Prospecting is expected to continue. There is sufficient spring water in some areas to support recreational mining.

Of the three iron deposits within or adjacent to the study area, the Black Jack mine and Cornfield Springs Consolidated mines are probably too small for commercial development. The remaining resources at the Vulcan mine-Burro prospect are probably not amenable to surface mining and would, therefore, have an excessively high production cost. At 1984 market conditions, foreign competition forced closure of some large open-pit iron mines of the western states, such as the Eagle Mountain mine near Desert Center, CA.

The 18 samples of limestone and dolomite taken from within and near the study area are of a reconnaissance nature only. An intensive mapping, sampling, and drilling program, followed by chemical and physical analyses, would be needed to adequately evaluate the suitability of the limestone and dolomite for specific industrial uses. Analyses suggest the carbonate rocks are suitable for at least intermediate grade industrial applications, which is the main market of raw carbonate products. However, the dolomite at Foshay Pass is probably too high in SiO_2 and Fe_2O_3. Favorable characteristics of these occurrences are their quality and quantity, the proximity of railroad facilities at Kelso, and the high demand and many processing plants in Southern California (Bowen and others, 1973, plate 2; Smith, 1984). Unfavorable characteristics are the rugged terrain, lack of local access roads (except to the dolomite in Foshay Pass), and the long distance to prospective market areas.

Only one of four samples of silica meets the standards for industrial applications; however, the small size of the deposit and the transportation costs to ready markets indicate the occurrence has little economic significance. The high amount of impurities in samples from two other sites indicates these deposits will probably not be considered as sources of industrial silica.

The large deposits of limestone, dolomite, common borrow, and sand and gravel within the study area probably will not be developed in the near future due to the relatively high-bulk/low-unit values and the high transportation costs to serve distant market areas. However, should resources closer to market areas be depleted, the size and grade of the Providence Mountains deposits and their proximity to the Kelso railhead, could attract development. The most likely local demand of limestone and dolomite aggregate might be as railroad ballast or as riprap along roads susceptible to flash flood damage.

Although stone suitable as a decorative veneer or as dimension stone has been quarried within the study area, the relatively high-bulk/low-unit value of the commodity and the high transportation costs to distant market areas are key factors controlling current or future development. Quarrying of these deposits in the foreseeable future, other than for localized uses, is unlikely.

Minor petrified wood localities are subject to occasional recreational use; however, no large-scale commercial interest is expected.

No lands within or adjacent to the study area are classified as "known geologic structures" or as "prospectively valuable for oil and gas" (U.S. Geological Survey, 1982).

No other significant resources are known to occur in the study area. Further studies are needed to determine if hydrocarbon or geothermal resources are present at depth.

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APPENDIX A: Mineral Property Reports

(numerical order)

APPENDIX A.--Mineral Property Reports

LIST OF PROPERTY REPORTS

No.	Name
22	Francis mine
23	Castor-Pollux mine (Columbia mine, Macedonia mine)
31	Prospect
32	Dixie No. 2 prospect
34	SS No. 28 prospect, north
35	SS No. 29 prospect, north
38	SS Nos. 20-22, 27-29 mine, south (Star [?] mine)
57	Globe mine
64	Frisco No. 3 mine
69	Double H Nos. 1 and 2 mine
72	Providence mine
77	Okaw mine
96	Jo Je mine
99	Green Scorpion prospect
102	Fan 1-5 prospect
104	Pink Jack prospect
112	Tough Nut mine
118	Black Jack mine
121	Cornfield Springs Consolidated mine
122	Rex mine
128	Vulcan mine-Burro prospect
139	Good Hope mine
144	Silver King mine (Perseverance mine)
146	Bonanza King mine
150	Grande 1-7 mine
153	Max Dor 1 and 2 mine
154/155	Gold Star North 1-44 and Gold Star 1-10 prospects

APPENDIX A.--Mineral Property Reports-continued

ILLUSTRATIONS

Figure A-1--Surface map, Francis mine
A-2--Underground map, south crosscut, Francis mine
A-3--Surface map, Castor-Pollux mine (Columbia mine, Macedonia mine)
A-4--Underground map, adit 3 and shaft 3, Castor-Pollux mine (Columbia mine, Macedonia minc)
A-5--Underground map, adit 2, Castor Pollux mine (Columbia mine, Macedonia mine)
A-6--Surface map, Prospect 31
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A-8--Surface and underground maps, SS No. 28 prospect, north
A-9--Surface and underground maps, adits 1 and 2, SS No. 29 prospect, north
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A-30--Total intensity magnetic profiles and geologic sections, A-A'-A" and B-B'-B", Black Jack mine
A-31--Surface map, Cornfield Springs Consolidated mine
A-32--Surface and underground maps, Rex mine
A-33--The Vulcan mine viewed toward the north-northwest. Bedded limestone and dolomite crop out in the upper right portion, and quartz monzonite crops out on the left and foreground

APPENDIX A.--Mineral Property Reports-continued

A-34--The Good Hope mine, viewed toward the west, showing two adit portals in the foreground and discontinuous vein outcrops in the background
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A-36--Surface map, Silver King mine
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A-40--Surface map, Bonanza King mine
A-41--Underground map, 4117 level, Bonanza King mine
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A-43--Underground map, level 2 (3,950 ft), Bonanza King mine
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A-51--Surface map, Max Dor 1 and 2 mine, with underground map and section of shaft
A-52--Surface map, Gold Star North 1-44 and Gold Star 1-10 prospects, and underground maps and sections, shafts 1, 3, and 4
A-53--Total intensity magnetic (proton magnetometer) and VLF electromagnetic profiles (three point running average) and a geologic section D-D', Gold Star 1-10 prospect

APPENDIX A.--Mineral Property Reports-continued

TABLES

Table A-1--Production from the Castor-Pollux mine (Columbia mine, Macedonia mine) recorded in USBM statistical files
A-2--Production from the Jo Je mine recorded in USBM statistical files
A-3--Production from the Bonanza King mine recorded in USBM statistical files

NAME: Francis mine

INDEX MAP NO.: Plate 1, no. 22

LOCATION: S1/2NE1/4 sec. 4, T. 11 N., R. 14 E. S.B.M., 0.2 mi outside of the study area.

ELEVATION: 4,360 to 4,520 ft.

ACCESS: From Kelso, CA, 8.3 mi northeast on paved Kelso-Cima Road to Dawes Siding, then 4.8 mi southeast on the four-wheel-drive Macedonia Canyon Road, then 0.8 mi southeast to lower mine area.

HISTORY: The deposit was discovered about 1900 and reopened in 1917 by the Francis Copper Mining Co. (Tucker, 1918a; 1921, p. 341). San Bernardino County records show the Cuyamaca and Woods Lodes located in 1911, the Western Star Lode located in 1916, the Fanny Nos. 1-3, the Amos No. 1, the Ramona Lode, and the Monte Video Lode located in 1930. A claim map (Tucker, 1918a) shows the Francis and Confidence Copper properties as a continuous series of claims. The mines may have been developed together since Edward Bluett, superintendent of the Francis mine, was also the owner of the Confidence Copper mine. Considerable development work and some production occurred in 1918. Francis Copper Mining Co. located a millsite near the mine in 1925. C. Nichols and H. Martin optioned the property in 1943 and received a preliminary development loan from the Reconstruction Finance Corp. to dewater and retimber the mine (Tucker and Sampson, 1943, p. 434). Francis Copper Mining Co. held the mine for many years and filed assessment work with the BLM as recently as 1977 to 1979, but abandoned the property in 1982 (C. L. La Rue, personal commun., 1982).

PRODUCTION: USBM statistical files record 200 crude tons, containing 2,377 oz silver (average grade 11.9 oz/ton; troy ounce per ton) and 10,626 lb copper (average grade 2.7 percent), produced in 1918. Tucker (1918a) reported 500 tons produced at a rate of 30 tons per month and subsequent literature (Tucker, 1921, p. 341; Tucker and Sampson, 1930, p. 212-213; 1931, p. 271-272; 1943; Eric, 1948, p. 305; and Wright and others, 1953, p. 9 tables) reported 300 to 307 tons produced.

GEOLOGY OF DEPOSIT: Tucker and Sampson (1930, p. 310-312, 1931, p. 271-272) describe the property as having three subparallel veins over an area 1,200-ft wide by 4,500-ft long. The main vein is referred to as the Cuyamaca vein or the Woods Dike No. 3. The conspicuously outcropping vein is 5 to 10 ft thick, strikes N. 60° to 70° E., and dips 65° to 85° NW. in bleached, sheared, Precambrian granite gneiss. A Mesozoic granitic intrusion underlies the gneiss at shallow depth. The white to translucent gray, iron-oxide stained quartz contains pyrite, limonite pseudomorphs after pyrite, galena, chalcopyrite, sphalerite, fluorite, and possibly scheelite and/or wolframite.

The workings are spread over approximately 1,700 ft of strike length on the Cuyamaca vein which has a vertical exposure of at least 120 ft (fig. A-1). Tucker and Sampson (1943, p. 434) noted the vein can be traced for 2,500 ft along strike. Several workings to the west-southwest of the Woods No. 2 shaft (plate 1, nos. 18, 25, and 27) are on structures of a similar trend.

WORKINGS AND FACILITIES: Six shafts (one caved), three adits, and three pits are on the property (figs. A-1 and A-2). Tucker (1918a; 1921, p. 341) and Tucker and Sampson (1930; 1931) describe the workings in detail. Since the shafts are not accessible at this time, it is difficult to correlate the literature descriptions with the workings found in the field. Tucker (1918a) described an 85-ft vertical shaft with 360 ft of drifts and crosscuts (on the 25-, 45-, and 75-ft levels), on a 125-ft-long by 3-ft-thick "pay-shoot," and a 120 ft "crosscut south at shaft level." Developments also included 55- and 35-ft shafts west of the Francis shaft. Tucker and Sampson (1930, p. 212-213; 1931, p. 271-272) described the Francis shaft as 140 ft deep with 600 ft of drifts and crosscuts on the 70- and 136-ft levels and a 160-ft connecting drift on the 70-ft level to another shaft. In addition they describe the inclined, 100-ft-deep Godshall shaft and the vertical, 40-ft-deep Woods No. 2 shaft. Their locations on figure A-1 are surmised from geographic descriptions. It is speculated that the raise in the south crosscut (fig. A-2) was the original 85-ft shaft which was boarded over, backfilled, or caved. A comparison of the volume of the Francis shaft dump with the estimated total volume of Francis shaft workings described by Tucker (1918a) and Tucker and Sampson (1930, 1931) revealed both to be in the range of 30,000 to 35,000 ft^3.

A concrete water-holding tank and other foundation structures are approximately 1,500 ft north-northwest of the Woods No. 2 shaft. In addition, the remains of wooden structures are on the Francis shaft dump and along the access road northeast of the collapsed shaft (fig. A-1).

SAMPLING: Analyses of six chip, two random chip, five grab, and two select samples are shown in the table accompanying figures A-1 and A-2. One sample from the south crosscut and two from the area of the Francis dump contained a trace gold. Copper, lead, and zinc values do not exceed 1 percent for 13 samples analyzed. Thirteen samples which contained silver ranged from 0.1 to 5.8 oz/ton including seven which ranged from 1.0 to 5.8 oz/ton. The two highest silver analyses were of samples selected from small stockpiles. Analyses for molybdenum, tungsten, and tin revealed spotty and low, but anomalous values. Five fluorine analyses ranged from 0.1 to 1.0 percent.

Ore grades cited by Tucker and Sampson (1930, p. 212-213; 1931, p. 271-272), probably from the area of the pay-shoot, ranged from 2.72 oz/ton silver, 3.08 percent copper, and 16.20 percent zinc on the 136-ft level to 15.7 oz/ton silver and 9.45 percent copper on the 70-ft level of the Francis shaft. The Godshall shaft dump is cited as having 12.2 oz/ton silver and 1.2 percent copper. Overall, the values are said to

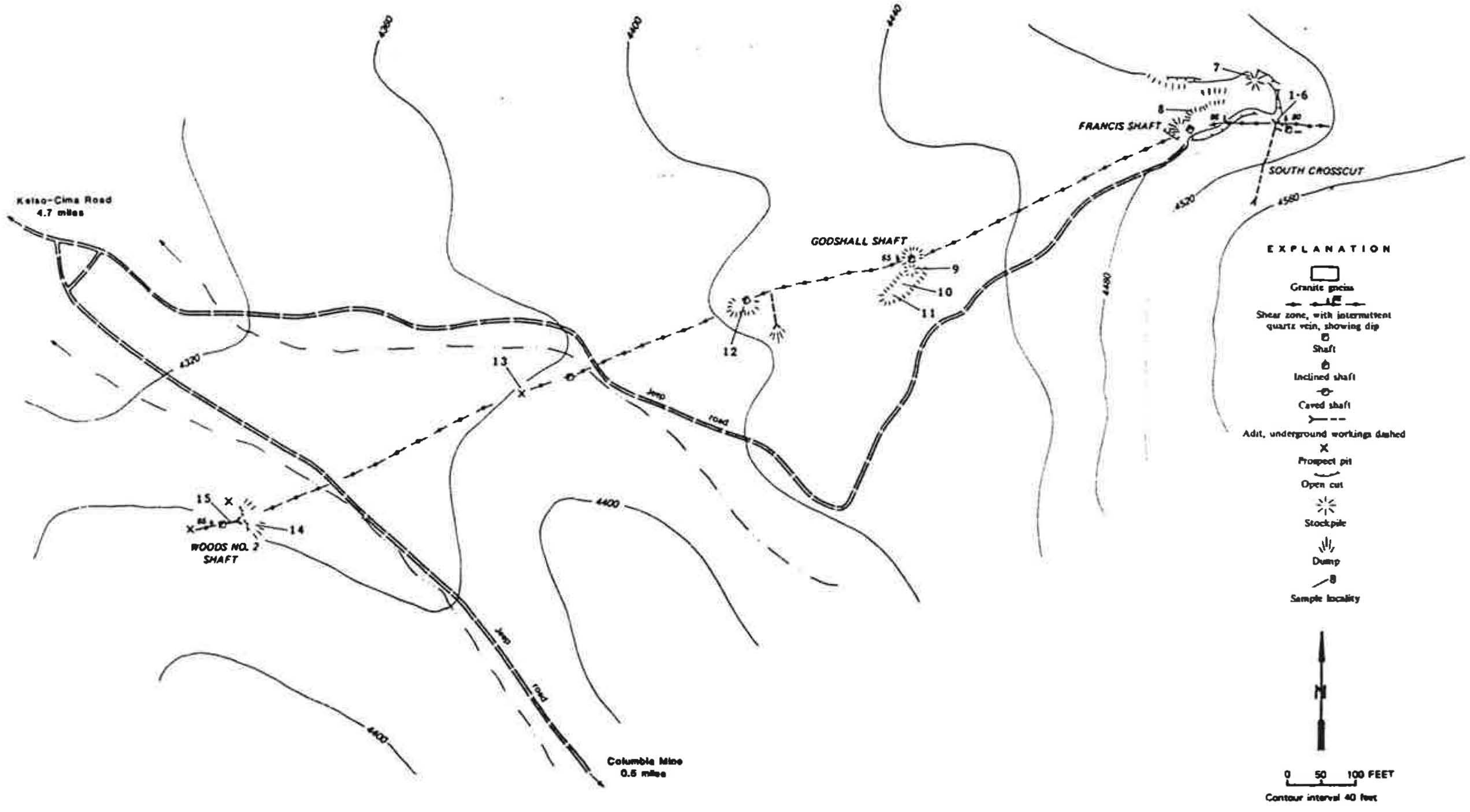

FIGURE A-1 – Surface map, Francis mine

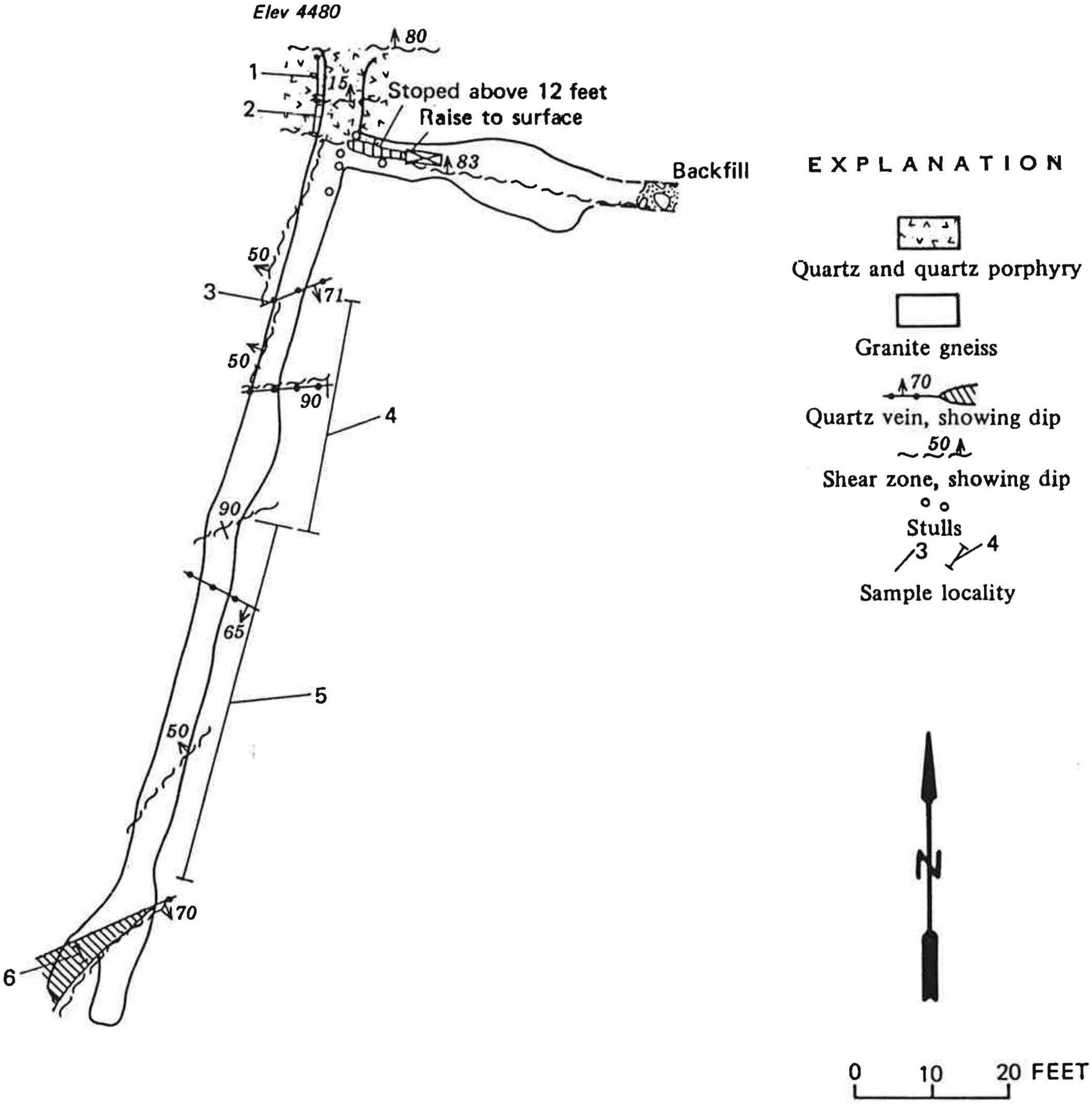

FIGURE A-2–Underground map, south crosscut, Francis mine

Data for samples shown in figures A-1 and A-2

[Tr, trace; N, none detected; --, not analyzeo; NA, not applicable]

Sample											
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)	Tungsten trioxide (%)	Tin (%)
1	Chip--	5.0	Sheared, iron-oxide stained, sulfide-bearing, gray quartz and quartz porphyry with abundant boxwork structures----------------	N	1.6	0.079	0.59	0.027	0.015	N	0.0006
2	do----	4.5	Predominantly gray quartz with pyrite, galena, and iron oxides; occurs in bleached, sheared granite gneiss-----------	N	1.3	.116	.82	.040	N	0.0010	.0005
3	do----	1.5	Massive, gray, iron-oxide stained, sulfide-bearing quartz 1 ft thick with boxwork structures and 0.5 ft of silicified, altered gneiss with a few quartz veinlets--	N	.2	.0096	.015	.0068	N	--	--
4	Random chip--	NA	Through 30 ft of friable to punky, iron-oxide stained, banded granite gneiss-------	N	N	.019	.0023	.031	N	N	.0005
5	do----	NA	Through 50 ft of banded granite gneiss with occasional quartz veinlets and some pyrite------------------------------------	N	N	.026	.0083	.021	N	N	N
1/ 6	Chip--	5.2	Intensely iron-oxide stained, brecciated, pyrite-bearing quartz and argillically altered, silicified, banded granite gneiss.	Tr	.2	.030	.0043	.024	N	.0010	N
7	Select	NA	Pyrite, galena, and sphalerite disseminated in quartz and gneiss from stockpile-------	Tr	5.8	.55	.49	.245	.0022	N	.0005
8	Grab--	NA	Sulfide-rich, iron-oxide and sulfur stained quartz and gneiss from dump--------------	Tr	1.0	.034	.151	.125	.0022	.0007	.0005
1/ 9	Select	NA	Massive to aggregated pyrite intergrowths in gray, translucent quartz with some chalcopyrite and secondary copper minerals.	N	3.2	.77	.38	.40	N	N	.0038
1/10	Grab--	NA	Iron-oxide and sulfur stained, altered gneiss and gray, translucent quartz with boxwork structures. Gneiss has minor fluorite; quartz contains pyrite, chalcopyrite, galena, and minor secondary copper minerals---------------------------	N	.8	.018	.096	.081	N	.0010	.0006

Data for samples shown in figures A-1 and A-2--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)	Tungsten trioxide (%)	Tin (%)
No.	Type	Length (ft)	Description								
1/11	Grab--	NA	Altered gneiss with minor disseminated sulfides----------------------------------	N	0.5	0.140	0.029	0.067	N	0.0007	0.0007
1/12	do----	NA	Massive to brecciated, iron-oxide and sulfur stained quartz and silicified gneiss gneiss from dump-------------------------	N	.6	.0036	.011	.0086	N	.0007	.0006
13	Chip--	6.0	do---	N	.1	.0063	.0031	.0041	--	--	--
14	Grab--	NA	Chrysocolla-bearing quartz (50%-70%) in buff to white, pyrite-bearing fault gouge	N	1.0	--	--	--	--	--	--
15	Chip--	9.0	Siliceous, bleached, sericitically altered gneiss with many quartz veins. Quartz is gray-white and contains fresh pyrite, limonite after pyrite, sericite pods, and boxwork and drusy structures----------	N	1.3	.043	--	--	--	--	--

1/ Fluorine analyses: sample 6 = 0.10%
sample 9 = 0.30%
sample 10 = 1.0%
sample 11 = 0.30%
sample 12 = 0.36%

range from 2 to 25 oz/ton silver, 2 to 12 percent copper, 2 to 6 percent lead, and 4 to 20 percent zinc. USBM samples did not confirm these values.

CONCLUSIONS: Since the shaft collars and deeper underground workings were not accessible to sampling, there are insufficient data to estimate resources. The Francis mine has a history of minor production of silver and copper ore which also contained significant values in lead and zinc. Most production was probably from a small, localized ore shoot. Assuming it extended to a 140-ft depth, the size of the pay-shoot was approximately 5,000 tons. However, the length and persistence of the vein system(s), the consistently significant silver values, and the presence of copper, lead, and zinc in samples indicate this property merits further investigation. Individual deposits may be about 5,000 to 10,000 tons in size.

NAME: Castor-Pollux mine (Columbia mine, Macedonia mine)

OWNER: Donald Sterner

INDEX MAP NO.: Plate 1, no. 23

LOCATION: E1/2NW1/4 sec. 3, T. 11 N., R. 14 E., S.B.M., located 0.25 mi outside of the study area boundary.

ELEVATION: 4,680 to 4,720 ft.

ACCESS: From Kelso, CA, 8.3 mi northeast on paved road to Dawes Siding, then 4.0 mi southeast on four-wheel-drive Macedonia Canyon Road, then 1.7 mi east on the Columbia mine access road (locked gate on road).

HISTORY: This property is best known as the Columbia mine. It was first named the Macedonia mine in the mid-1860's, when it was in the Rock Spring/Macedonia mining district (Vredenburgh and others, 1981, p. 89) which was abandoned in 1866. Tucker (1921, p. 340) reported the Columbia mine in the Kelso mining district was owned by Adam Boech. Development included a 350-ft (?) inclined shaft with drifts on the 100-ft, 200-ft and 300-ft levels and a five-stamp mill, and the mine was idle. Tucker and Sampson (1930, p. 275; 1931, p. 348) reported the property was owned by Mrs. R. P. Greenleaf and V. E. Stockwell, and leased to J. G. Thorne. In 1935-1936 the Columbia mine was leased to Columbia Mines, Inc. (Tucker and Sampson, 1943, p. 447). The five-stamp mill was rehabilitated and flotation was added. Eau Claire Ore Co. of Kelso operated the property in 1938 (Eric, 1948, p. 302, 311; Wright and others, 1953, p. 75 tables; Goodwin, 1957, p. 650). Mr. Donald Sterner has held the Castor-Pollux claims on the Columbia mine since 1966. He has conducted vat and pad leach experiments on materials from dumps, the ore bin, and a tailings pond.

PRODUCTION: The San Bernardino Guardian (June 29, July 13, Sept. 21, 1872) noted that 15 tons of ore valued at $650/ton was shipped from the Macedonia mining district. Some of this production may have been from the Macedonia (Columbia) mine. The Barstow Printer (April 21, 1911) reported concentrates from the Columbia mine, managed by Frank Dayton, were running "about $365 per ton." Table A-1 shows production recorded by USBM statistical files. Considering the relative size of the underground developments in the mine, actual production might be several times that which is reported.

GEOLOGY OF DEPOSIT: The Columbia mine lies along the northern projection of the East Providence fault zone; however, no definitive expression of the fault was noted. The main workings are on two or more east-northeast-trending, moderately southeast-dipping quartz veins in probable Precambrian lenticular to banded granite gneiss. A contact with

TABLE A-1.--Production from the Castor-Pollux mine (Columbia mine, Macedonia mine) recorded in USBM statistical files

(--, none recorded; NA, not applicable)

Year	Crude ore (tons)	Gold		Silver		Copper		Lead	
		Recovered (oz)	Average grade (oz/ton)	Recovered (oz)	Average grade (oz/ton)	Recovered (lb)	Average grade (%)	Recovered (lb)	Average grade (%)
1926	35	10.17	0.29	1,351	38.6	--	NA	--	NA
1928	22	5.94	.27	670	30.5	426	0.97	--	NA
1937	82	71.00	.87	--	NA	2,200	1.34	--	NA
1938	3	2.00	.67	146	48.7	--	--	100	1.67
Total	142	89.11	NA	2,167	NA	2,626	NA	100	NA
Average	NA	NA	.63	NA	36.1	NA	1.26	NA	1.67

granitic rock of the Mid Hills Adamellite (Beckerman, 1981) may be several hundred feet below the surface. It is exposed at an elevation of 4,300 to 4,400 ft within 1/4 mi of the mine. Tucker (1921, p. 340) mentioned a diorite footwall and a porphyry hanging wall. The deeper underground workings may have reached the intrusive.

The main shaft (fig. A-3, shaft 3) and underground workings develop a quartz vein which is no longer accessible due to flooding, and no surface exposure was observed. Adit 3 (figs. A-3 and A-4) is a drift on a friable-to-silicified, iron-oxide stained gouge zone with gray quartz veins and pods. This zone is approximately parallel to the main zone and 80 ft to the southeast. It crops out for approximately 300 ft along strike. Tucker and Sampson (1930, p. 275; 1931, p. 348) noted a 300-ft crosscut from the lower level of the mine reached a third, approximately parallel vein.

Hewett (1956, p. 133-134) observed that quartz has replaced the enclosing rock and there were several episodes of brecciation and cementation evident. Pyrite, chalcopyrite, galena, and sphalerite are associated with quartz veins and silicified zones. A petrographic sample from the main dump contained approximately 30 percent sulfides and iron-oxide alteration products in a matrix of brecciated and cemented quartz and calcite veining. Purple fluorite was observed in adit 2 and the dumps of adit 3 and shaft 4.

Miscellaneous workings to the north and south of the main mine area develop apparently localized, generally north-to-northeast-trending, easterly-dipping shear zones. These may be related to a wide, diffuse zone of shearing associated with the East Providence fault.

WORKINGS AND FACILITIES: Workings consist of four shafts, three adits, one trench, and three pits (figs. A-3, A-4, and A-5). Shaft 1 is 20-ft deep, shaft 2 is caved at the collar, and shaft 4 is flooded at the surface. Shaft 3 is inclined 45^0 to 50^0 S. to SE. and is 320- to 350-ft deep with drifts on 3 levels, but is flooded at 70 ft. Adit 1 is caved at the portal but may have been as long as 200 ft to 400 ft, adit 2 is 65 ft long, and adit 3 consists of a 100-ft crosscut, at least 360 ft of drift, overhand and underhand stopes, at least two flooded winzes, and an 80-ft crosscut which connects with the main shaft (no. 3) at 66 ft below the collar.

Surface developments (fig. A-3) consist of a trailer and storehouse, a windmill, an ore bin and mill foundation, a leach vat, a tailings pond, and access roads. An old headframe stands over shaft 3.

SAMPLING: Analyses of 17 chip, 1 random chip, 5 grab, and 2 select samples taken on the property are shown in the tables which accompany figures A-3, A-4, and A-5. Gold ranged from a trace to 0.11 oz/ton in 13 of the samples, and silver ranged from 0.1 to 25.2 oz/ton in 24 of the samples. Less than 1 percent copper, lead, and zinc were present in all samples.

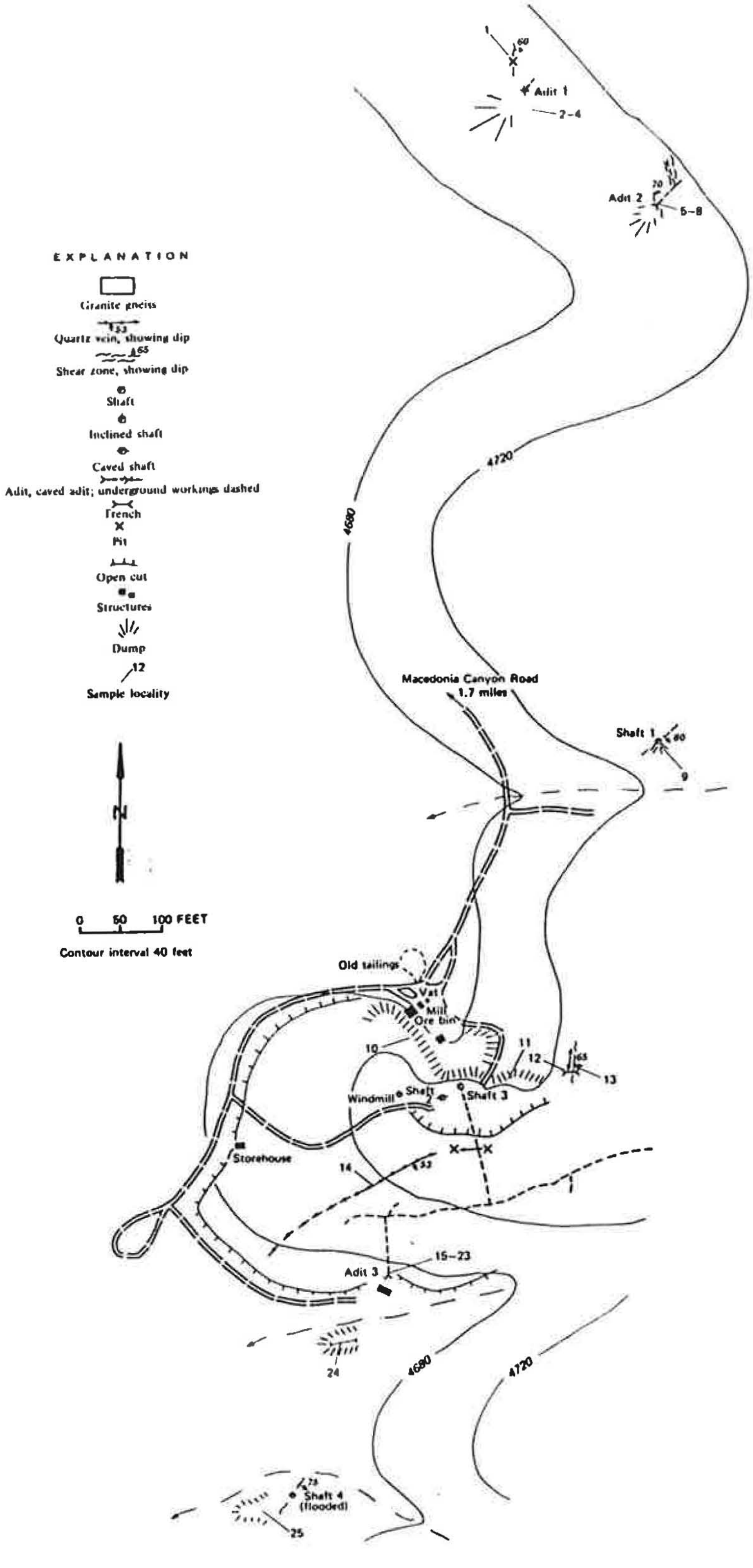

FIGURE A-3--Surface map, Castor-Pollux mine (Columbia mine, Macedonia mine)

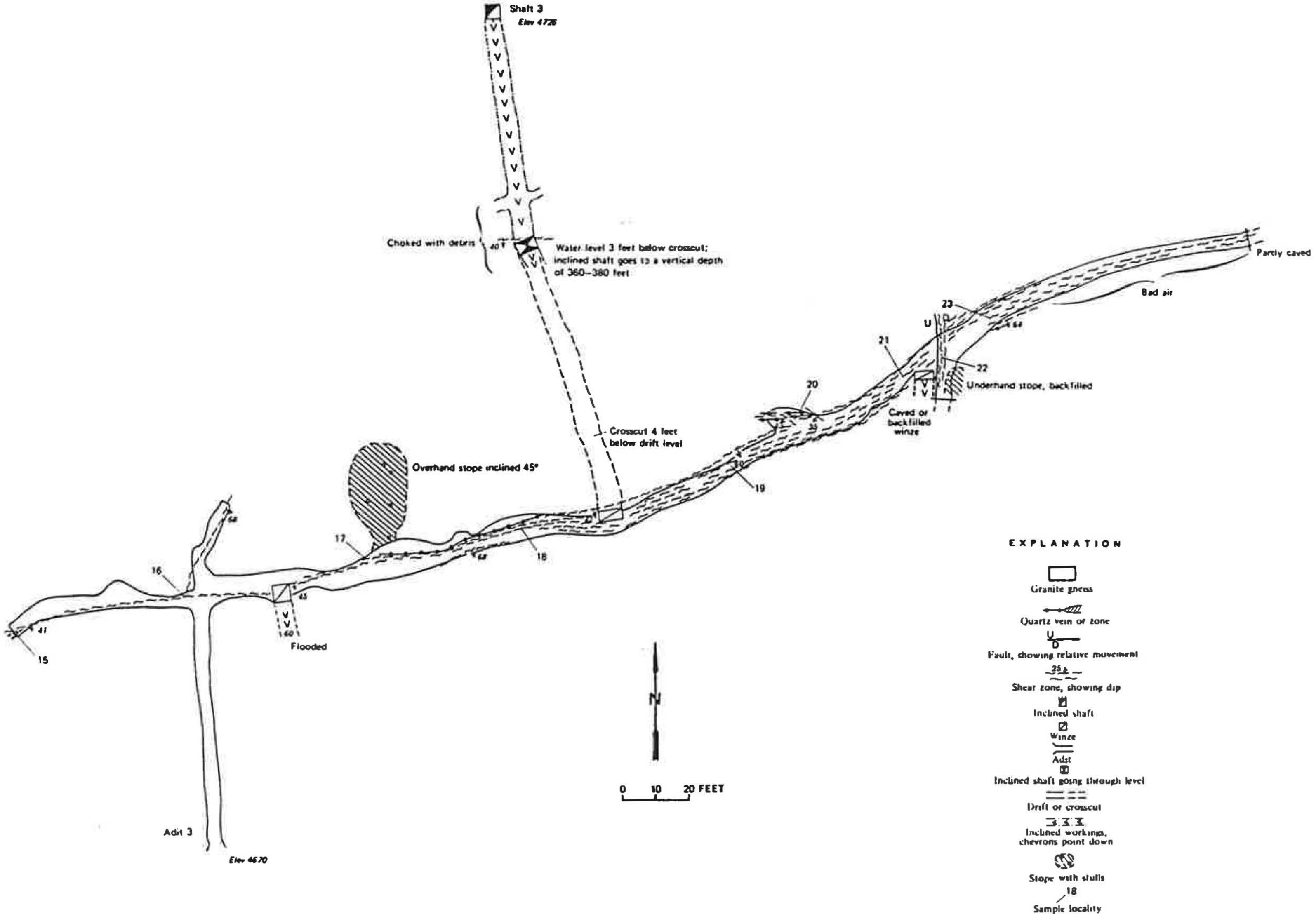
Shaft 3
Elev 4726
Choked with debris
40
Water level 3 feet below crosscut; inclined shaft goes to a vertical depth of 360–380 feet
Crosscut 4 feet below drift level
Overhand stope inclined 45°
Partly caved
Bad air
23
64
U
D
21
22
Underhand stope, backfilled
Caved or backfilled winze
20
35
19
17
18
68
16
45
60
Flooded
41
15
Adit 3
Elev 4670
N
0
10
20 FEET
EXPLANATION
Granite gneiss
Quartz vein or zone
U
D
Fault, showing relative movement
25
Shear zone, showing dip
Inclined shaft
Winze
Adit
Inclined shaft going through level
Drift or crosscut
Inclined workings, chevrons point down
Stope with stulls
18
Sample locality

FIGURE A-4— Underground map, adit 3 and shaft 3, Castor-Pollux mine (Columbia mine, Macedonia mine)

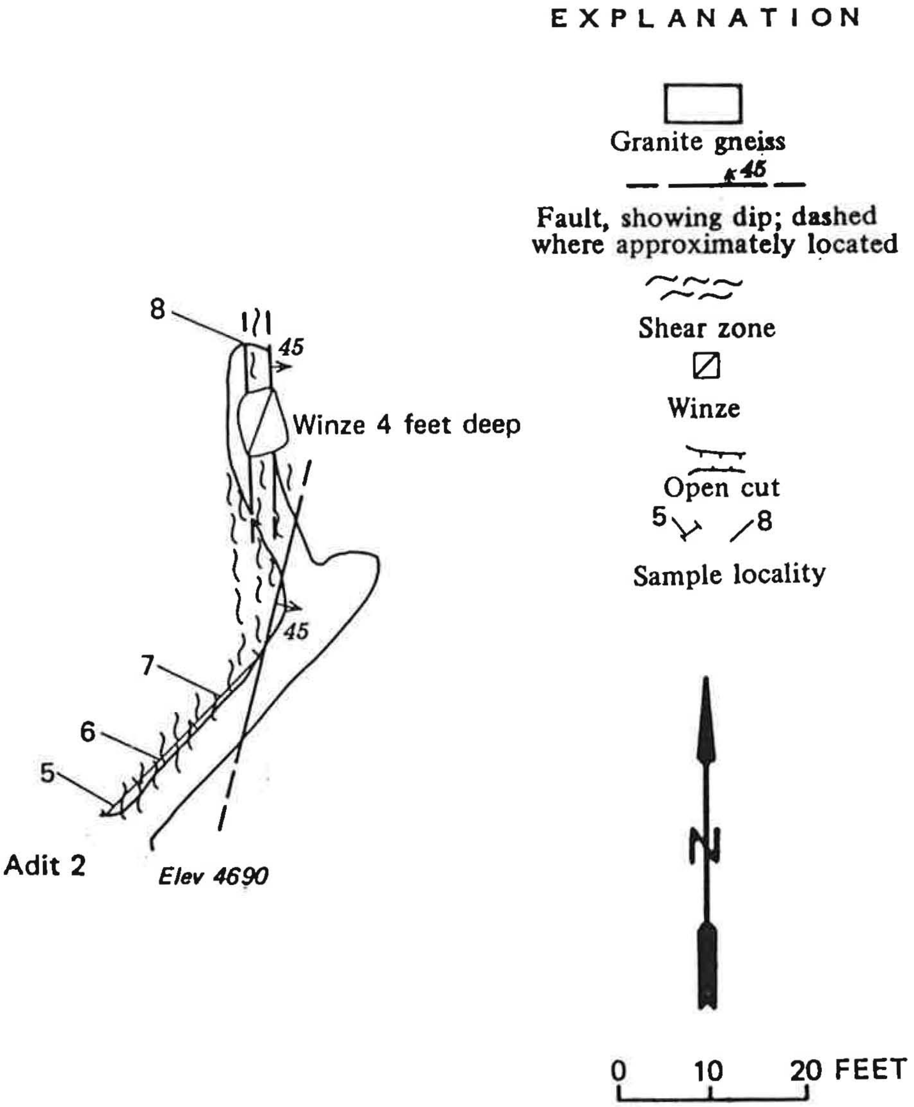

FIGURE A-5—Underground map, adit 2, Castor-Pollux mine (Columbia mine, Macedonia mine)

Data for samples shown in figures A-3, A-4, and A-5

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
1	Chip	8.0	Fault trends north, dips 60° E. and contains less than 10% quartz veins in fractured, silicified granite gneiss	N	0.1	0.025	0.030	0.32
2	Select	NA	Yellow, green, and buff friable, crystalline rock with quartz stringers and pervasive pyrite. This rock comprises 20% of dump	0.02	.1	.010	.058	.57
3	do	NA	Gray to black, fine-grained, equigranular igneous rock with abundant specularite and pyrite. This rock comprises 80% of dump	N	.2	.012	.013	.58
4	Grab	NA	From same dump material as samples 2 and 3	N	.1	.025	.030	.32
5	Chip	4.0	Across altered, punky granite gneiss and gouge	N	.1	--	--	--
6	do	4.0	do	N	.8	--	--	--
7	do	4.5	Silicified, iron-oxide stained gouge and granite gneiss	N	.5	--	--	--
8	do	4.5	Fault gouge	N	.5	--	--	--

Data for samples shown in figures A-3, A-4, and A-5--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
9	Random chip--	NA	Five-ft-thick shear zone in friable, iron-oxide stained granite gneiss with boxwork associated with minor silicification------	N	0.2	--	--	--
10	Grab--	NA	Abundant pyrite with minor galena and chalcopyrite in quartz and chloritically altered granite gneiss from dump----------	0.01	3.7	0.0087	0.079	0.235
1/ 11	do----	NA	do--	.11	5.8	.014	.244	.50
1/ 12	Chip--	7.0	Across gray quartz and silicified, brecciated granite gneiss with boxwork---------------	N	4.0	.029	.241	.048
1/ 13	do----	7.0	Across predominantly gray to red clay gouge with wedges of altered, fractured granite gneiss------------------------------------	N	1.6	.018	.155	.165
1/*14	do----	3.5	Intensely iron-oxide stained quartz vein with minor pyrite-------------------------	.11	25.2	.0073	.64	.049
*15	do----	3.6	Iron-oxide stained, mottled white to gray, fractured quartz vein or lens 2 to 5 ft thick; and banded, red to gray gouge zone 1.5 ft thick; contains minor pyrite and boxwork------------------------------------	.04	5.3	.0058	.103	.090
*16	do----	3.0	Clay and brecciated quartz-----------------	.07	10.0	.0068	.35	.33

Data for samples shown in figures A-3, A-4, and A-5--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
*17	Chip--	4.0	Intensely silicified zone of gray quartz veins bearing pyrite, gouge, and altered granite gneiss with quartz---------------	0.04	6.8	0.010	0.171	0.147
*18	do----	3.5	Iron-oxide stained, brecciated quartz and gouge-------------------------------------	.07	10.4	.014	.127	.126
*19	do----	5.2	Gouge and shear zone contains silicified gneiss with pyrite and gray to white quartz veinlets-------------------------	.03	6.2	.033	.104	.231
20	do----	4.5	Quartz and breccia in shear zone-----------	.01	1.7	.0092	.036	.088
21	do----	3.0	Stringers of gray to white gouge in silicified, altered gneiss bearing pyrite in silicified zones----------------------	N	.1	.0034	.019	.040
22	do----	3.0	Crosscutting shear has brecciated quartz and gneiss--------------------------------	N	N	.0007	.0025	.0069
23	do----	3.5	Punky, friable sheared gneiss and green clay gouge with dark brown, friable iron-oxide stringers; hanging wall has 0.3-ft-thick silicified zone with pyrite--------------	Tr	.9	.0077	.161	.183
1/ 24	Grab--	NA	From main adit dump-----------------------	.05	9.2	.0073	.214	.094

Data for samples shown in figures A-3, A-4, and A-5--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
1/ 25	Grab.	NA	Fault zone in mottled pink and dark gray banded gneiss containing pyrite, sphalerite, and galena--------------------------------	Tr	0.2	0.0042	0.31	2.68

---

* Analyses used to calculate tonnage and grade.

1/ Additional analyses:

Sample 11 Molybdenum, tungsten, tin = N; fluorine = 0.063%
Sample 12 Molybdenum, tungsten = N
Sample 13 Molybdenum, tungsten = N
Sample 14 Molybdenum = 0.0050%; tungsten = N
Sample 24 Molybdenum, tungsten, tin = N; fluorine = 0.040%
Sample 25 Molybdenum, tungsten, tin = N; fluorine = 0.079%

RESOURCE ESTIMATE: The vein developed by a drift from adit 3 contains high silver and moderate gold values. Samples 14 through 19 contained from 0.03 to 0.11 oz/ton gold and 5.3 to 25.2 oz/ton silver. Sample values dropped greatly to the east of sample site 19. Using samples 14 through 19, there is an estimated 5,600 tons of indicated resources with a weighted average (area of influence) grade of 0.05 oz/ton gold and 9.1 oz/ton silver. Below and west of the indicated resources, there is an estimated 18,000 tons of inferred resources in a block 330 ft along strike (from the western surface exposure to just east of sample 19), with a down dip projection of 165 ft below the adit and an average thickness of 3.8 ft. The grade of the inferred resource is assumed to be the same as the indicated resource grade. A tonnage factor of 12 ft^3/ton (cubic feet per ton) was used.

CONCLUSIONS: The deposit contains an identified subeconomic resource of approximately 23,000 tons at an average grade of 9.1 oz/ton silver and 0.05 oz/ton gold. At gold and silver prices of $400/oz and $10/oz, respectively, the resource has an estimated unit value of $111/ton. Based on past production, the identified gold and silver resources, and the presence of copper, lead, and zinc, this property warrants further investigation for additional resources. The northwestern-most vein system, developed to a depth of more than 300 ft by workings from the main shaft (fig. A-3, shaft 3), was not examined and may contain additional resources.

NAME: Prospect

INDEX MAP NO.: Plate 1, no. 31

LOCATION: W1/2SW1/4SW1/4 sec. 3 and E1/2SE1/4SE1/4 sec. 4,
T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,600 to 4,910 ft

ACCESS: From Kelso, CA, drive 8.3 mi northeast on the paved Kelso-Cima Road to Dawes Siding, then 5.0 mi southeast on the Macedonia Canyon Road to the Francis mine, then 0.5 mi south cross-country.

GEOLOGY OF DEPOSIT: The deposit occurs as a system of quartz veins and veinlets in a fault zone that strikes N. 60° W. and dips 55° to 80° NE. in granite gneiss. In the fault zone are two prominent outcrops approximately 350 ft apart and about 6 ft thick. Quartz is white to gray, iron-oxide stained, and contains sulfide stringers, limonite pseudomorphs after pyrite, and secondary copper minerals. Fault gouge is gray-green and silicified. Gneiss near the fault zone is bleached. A second quartz vein, which crops out approximately 300 ft south of the main vein, strikes north, dips 30° E., and is 5.5 ft thick.

WORKINGS AND FACILITIES: Workings consist of three pits and a flooded adit of unknown length. The underground workings are of considerable size as shown by the extensive dump. The adit trends S. 20° W. and apparently reached the main vein.

SAMPLING: Five chip and one select sample were taken from the main vein, and a chip sample was taken from the north-trending vein. Sample localities are on figure A-6, and analyses are listed in the accompanying table. Gold was detected in all samples except a select sample from the adit dump, and silver was detected in all samples. Gold values ranged from 0.0009 to 0.0776 oz/ton, four of the samples contained 0.01 oz/ton gold, and silver values ranged from 0.34 to 0.9 oz/ton. Five samples contained 0.0046 to 0.0270 percent copper, 0.0440 to 0.27 percent lead, 0.0007 to 0.0400 percent zinc, and 0.0033 to 0.0420 percent molybdenum.

RESOURCE ESTIMATE: Based on an average thickness of 6.4 ft, a projected strike length of 380 ft, a projected depth of 175 ft, and a tonnage factor of 12 ft^3/ton, the main zone contains approximately 35,000 tons of inferred resources with a weighted average grade (samples 2-5, 7) of 0.04 oz/ton gold and 0.6 oz/ton silver.

CONCLUSIONS: The deposit contains a small- to moderate-sized subeconomic gold and silver resource similar to others in the vicinity. At precious-metal prices of $400/oz gold and $10/oz silver, the inferred resource has a value of approximately $20/ton. The size of the exposed deposit and the analytical values suggest additional vein-type gold and silver resources may occur at depth.

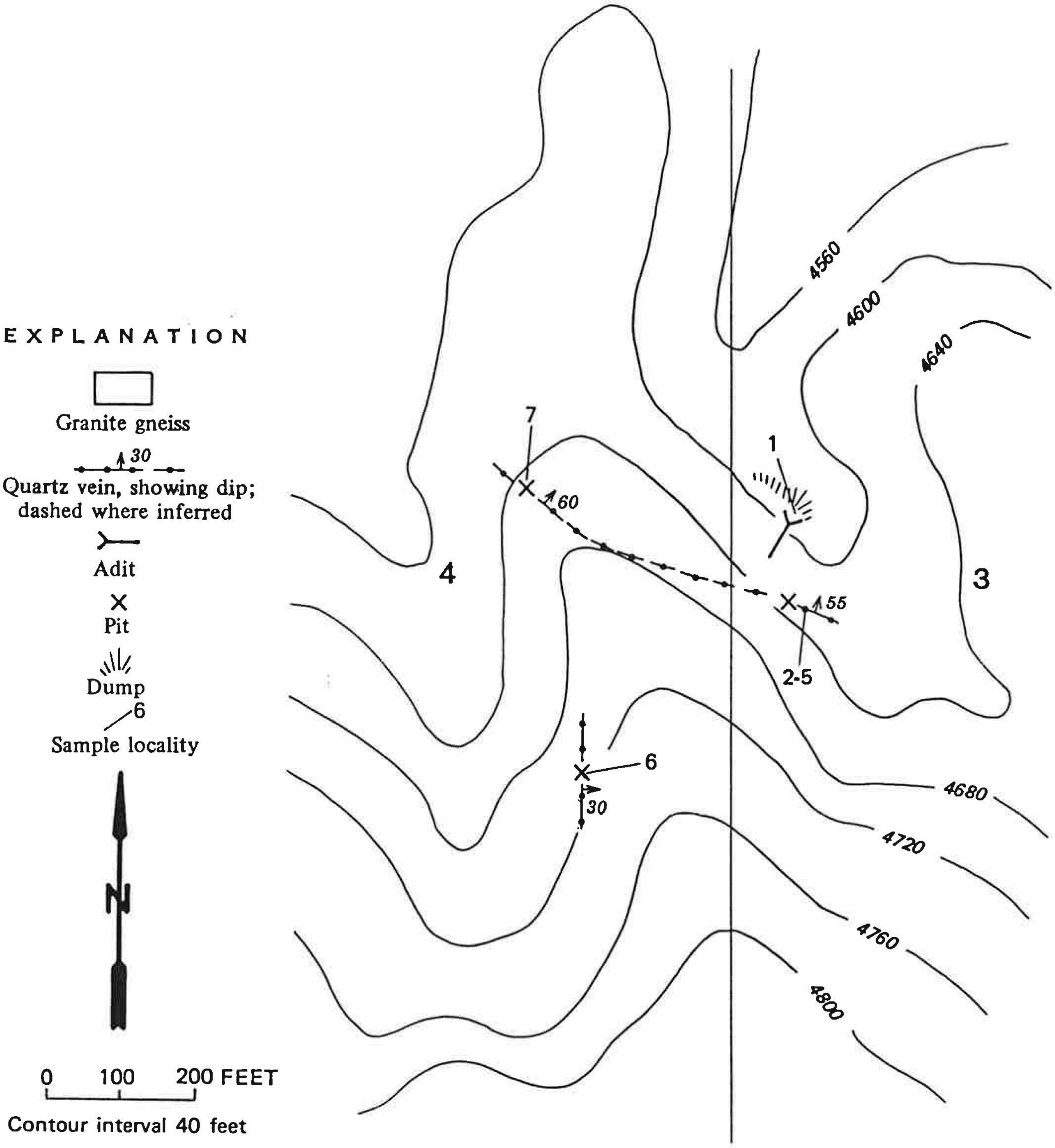

FIGURE A-6—Surface map, Prospect 31

Data for samples shown in figure A-6

[N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
1	Select	NA	Altered gneiss and white to gray iron-oxide stained quartz from adit dump contains sulfide stringers, limonite after pyrite, and secondary copper minerals------------------	N	0.8	0.0270	0.0560	0.0007	0.0055
*2	Chip--	2.9	Gray-green fault gouge between altered gneiss and quartz vein on main structure----------------	0.01	.5	--	--	--	--
*3	do----	1.6	Quartz vein with limonite after pyrite on main structure----------	.01	.9	--	--	--	--
*4	do----	1.8	Bleached, silicified to punky, slightly iron-oxide stained breccia in shear zone on main structure with quartz and altered gneiss fragments.	.01	.5	.0130	.12	.11	.0066
*5	do----	.6	Fractured, iron-oxide stained, gray to white quartz vein with moderate limonite after pyrite-------------	.01	.7	.0046	.16	.0170	.0033
6	do----	7.0	Across boxwork-bearing quartz vein 5.5 ft thick and dark, biotite-rich, altered gneiss 1.5 ft thick-------	.0009	.34	.0130	.0440	N	.0490

Data for samples shown in figure A-6--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
*7	Chip--	6.0	Across breccia zone with a few quartz veinlets on main structure----------	0.0776	0.52	0.0120	0.27	0.0400	0.0420

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* Samples used to calculate tonnage and grade.

NAME: Dixie No. 2 prospect

INDEX MAP NO.: Plate 1, no. 32

LOCATION: Center SW1/4 sec. 3, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,747 to 4,826 ft

ACCESS: From Kelso, CA, 8.3 mi northeast on the paved Kelso-Cima Road to Dawes Siding, then 4.5 mi southeast to the Confidence mine, then 1/2 mi south cross-country.

HISTORY: According to a notice found on the property, the mining claim was located by E. G. Graef and G. B. Moores in 1935.

GEOLOGY OF DEPOSIT: The deposit, which trends east and dips 60° to 85° S., is a silicified shear zone and quartz vein which has undergone post-emplacement brecciation and silica cementation (fig. A-7). The zone ranges in thickness from 2.4 to 5.0 ft, crops out for 350 ft along strike, and has a vertical exposure of 80 ft. The western portion of the zone has abundant siliceous, iron-oxide stained fault gouge and small amounts of vein quartz; however, vein quartz, commonly brecciated, increases eastwards. Quartz is gray, has abundant pyrite, and is generally stained with iron oxide or secondary copper minerals. Petrographic and microprobe examination of one specimen revealed that minor galena and sphalerite, as well as traces of chalcocite (Cu_2S), argentite (Ag_2S), and barite ($BaSO_4$), are contained in the pyrite. The lenticular to banded gneiss country rock is commonly bleached and sericitized near the vein. Several hundred feet west of the vein are small outcrops of fault gouge which are on line with the main zone. A localized, north-trending shear zone in gneiss is approximately 400 ft north of the main zone (sample site 10; not shown on figure A-7).

WORKINGS AND FACILITIES: The main zone is developed with a 56-ft-long adit, a 10-ft-deep shaft, and five pits (fig. A-7). The small shear zone to the north has one pit.

SAMPLING: Eight chip and one grab sample were taken on the main zone. These sample locations are shown on figure A-7, and sample analyses are listed in the accompanying table. Sample 10 (not shown on fig. A-7) taken on the shear zone to the north contained no gold or silver. Eight of nine samples from the main zone contained a trace to 0.02 oz/ton gold and 0.5 to 1.5 oz/ton silver. Copper ranged from 0.0019 to 0.011 percent, lead ranged from 0.012 to 0.059 percent, molybdenum ranged from 0.0031 to 0.0071 percent, and three of eight samples analyzed for zinc contained from 0.021 to 0.35 percent. The only sample from the main zone which did not contain gold or silver was taken from the footwall. In general, the silver and gold values increase to the east.

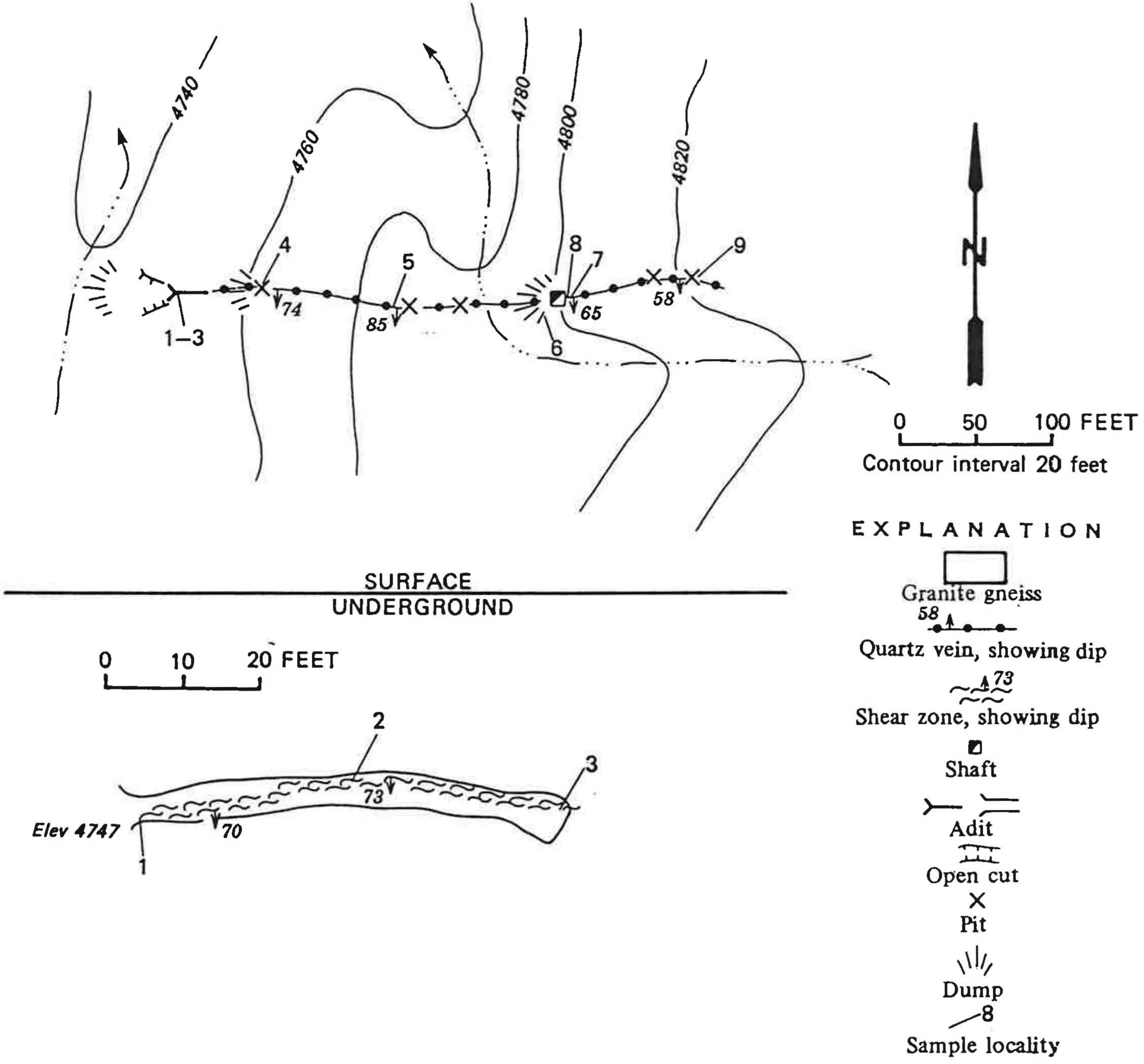

FIGURE A-7—Surface and underground maps, Dixie No. 2 prospect

Data for samples shown in figure A-7

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
*1	Chip--	2.6	Moderately iron-oxide stained, yellow to white, siliceous fault gouge with scattered quartz lenses	0.01	0.5	0.0019	0.012	N	0.0031
*2	do----	3.5	do--------------------------------	Tr	.6	.0052	.0590	N	.0062
*3	do----	2.4	do--------------------------------	.01	.9	.0060	.0240	0.0350	.0069
*4	do----	5.0	Silicified, white to buff gouge zone in granite gneiss; contains gray quartz with abundant pyrite, minor galena, sphalerite, and rare chalcocite, argentite, and barite	.01	1.5	.0022	.0310	N	.0051
*5	do----	2.0	Siliceous, abundantly iron-oxide stained quartz breccia with moderate sulfides----------------	.02	1.2	.0024	.0290	N	.0071
6	Grab--	NA	Sericitized, bleached gneiss with white to buff quartz containing minor secondary copper minerals---	Tr	.6	.0038	.0240	.0210	.0046
*7	Chip--	3.0	Massive, white quartz vein with no visible sulfides-----------------	.01	.6	--	--	--	--

Data for samples shown in figure A-7--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
8	Chip--	2.5	Shear zone on footwall of vein is white to green to buff and grades into fresh gneiss----------------	N	N	0.0110	0.0150	0.35	0.0035
*9	do----	5.0	Silicified quartz-gneiss breccia zone with moderate boxwork; quartz concentrated along walls and center of zone is bleached--------------	0.02	1.2	.0024	.0290	N	.0071
10	Random chip--	NA	Across 12 ft of sheared, silicified granite gneiss in zone which strikes N. 8° W. and dips 85° NE. (not shown on figure)------------	N	N	--	--	--	--

---

* Samples used to calculate tonnage and grade.

RESOURCE ESTIMATE: Based on a strike length of 350 ft, a projected depth of 175 ft (one-half of the strike length), an average thickness of 3.4 ft, and a tonnage factor of 12 ft^3/ton, the main zone contains an inferred resource of approximately 17,000 tons at an average grade, based on a weighted average of the samples taken across the silicified zone, of 0.01 oz/ton gold and 1.0 oz/ton silver.

CONCLUSIONS: The deposit contains a small subeconomic resource of gold and silver valued at approximately $14/ton at precious-metal prices of $400/oz gold and $10/oz silver. Similar deposits in the area, the extent of the vein, and the sample analyses indicate that additional gold and silver resources may be present at depth.

NAME: SS No. 28 prospect, north

INDEX MAP NO.: Plate 1, no. 34

LOCATION: SE1/4SW1/4 sec. 4, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,670 to 4,766 ft

ACCESS: From Kelso, CA, 8.3 mi northeast on the paved Kelso-Cima Road to Dawes Siding, then 4.5 mi southeast on the four-wheel-drive Macedonia Canyon Road to the Blue Rock claims area, then 1.0 mi south on foot.

HISTORY: The prospect was not claimed in 1982. Although the history of the property is unknown, the workings appear to be old.

GEOLOGY OF DEPOSIT: The deposit occurs in gneissic terrane; however, locally the gneiss is intruded by a dike or plug of medium- to fine-grained, felsic igneous rock which is silicified and intensely sericitized. The adit develops a 2- to 10-ft-thick zone of gouge, quartz, and quartz sericite which is localized along a fault that strikes N. 45° E. and dips 74° NW. to 90° in the felsic rock (fig. A-8). A petrographic sample from the zone was composed almost entirely of quartz and sericite with possible minor potassium feldspar. Approximately 3 to 5 percent of the sample consisted of euhedral pyrite cubes, and another 1 to 3 percent consisted of jarosite ($KFe_3[SO_4]_2[OH]_6$) pseudomorphs after pyrite. The zone crops out for 270 ft along strike, has a 96-ft vertical exposure, and horsetails on the north end.

WORKINGS AND FACILITIES: The property is developed by an 80-ft adit with a 5-ft winze and a 16-ft raise to the surface (fig. A-8). An old cabin is located in a drainage approximately 200 ft northwest of the adit.

SAMPLING: Nine chip samples were taken across the mineralized zone. Sample sites are shown on figure A-8, and analyses are listed in the accompanying table. Six samples contained gold, which ranged from a trace to 0.07 oz/ton, and seven contained silver, which ranged from 0.1 to 3.5 oz/ton. Of the six underground samples (nos. 1-6) across the main zone, gold averaged 0.03 oz/ton and silver averaged 1.1 oz/ton. Copper, lead, and zinc values do not exceed 1 percent.

RESOURCE ESTIMATE: The deposit contains an inferred resource of approximately 10,000 tons at a weighted average grade of 0.02 oz/ton gold and 0.9 oz /ton silver. The estimate is based on an average thickness of 3.2 ft, a strike length of 270 ft, a depth projection of 135 ft, and a tonnage factor of 12 ft^3/ton. Gold values decline to the northeast along the zone.

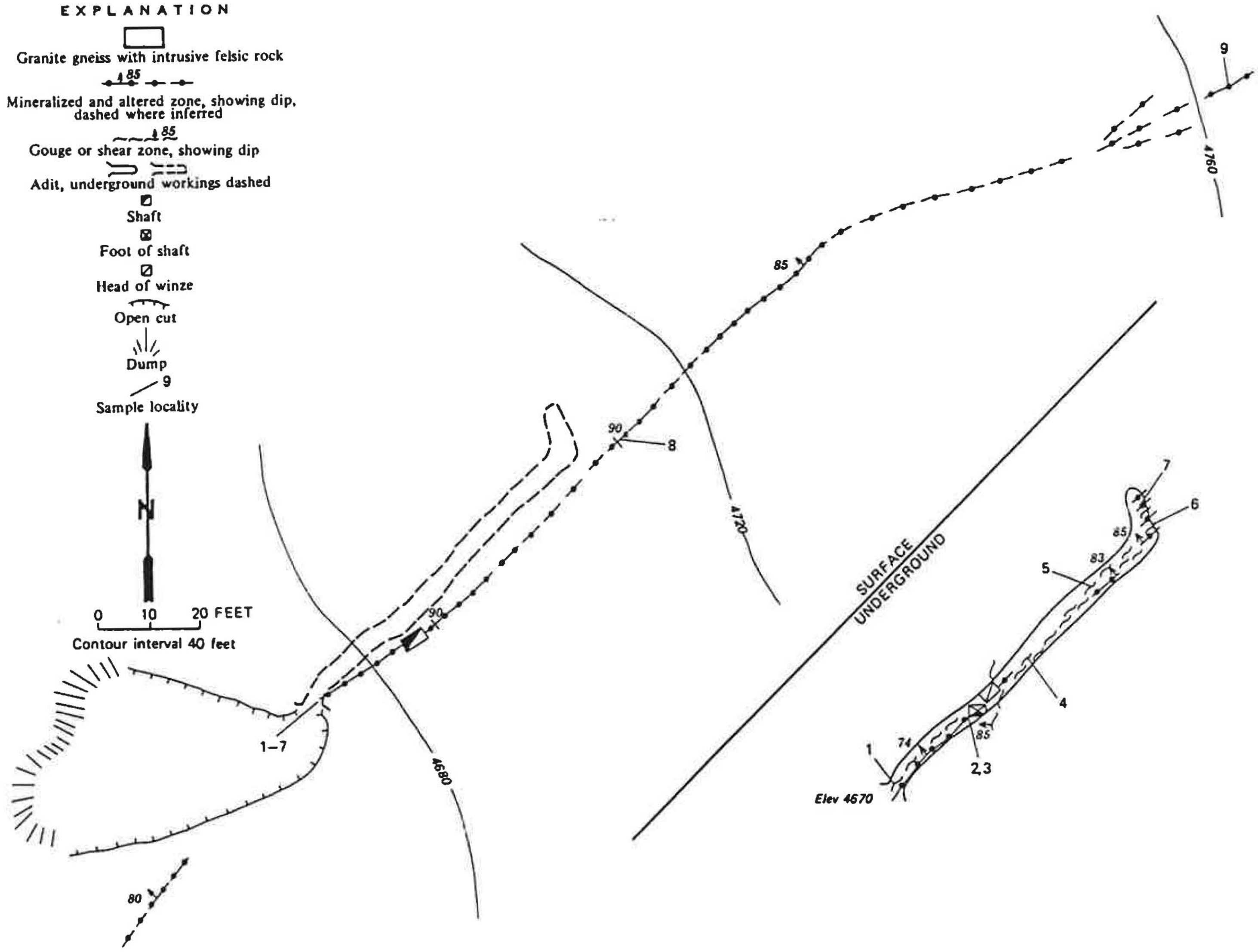

FIGURE A-8—Surface and underground maps, SS No. 28 prospect, north

Data for samples shown in figure A-8

[Tr, trace; N, none detected]

Sample				Gold	Silver	Copper	Lead	Zinc
No.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)	(%)	(%)
*1	Chip--	4.0	Across 3-in. shear zone and silicified, sericitized, fine- to medium-grained felsic igneous rock with iron oxide on fractures------------------------------	0.06	3.5	0.114	0.031	0.02
1/*2	do----	.4	Reddish-green, iron-oxide stained gouge zone with some quartz veins---------------	Tr	.5	.045	.024	.0059
1/*3	do----	1.7	Very silicified, greenish-gray rock with angular quartz grains, fresh pyrite cubes, and minor boxwork------------------	.07	1.4	.015	.042	.0020
*4	do----	2.0	Fault gouge and fresh country rock----------	.03	.5	.069	.015	.0051
*5	do----	3.0	Fractured country rock with minor pyrite----	Tr	N	.028	.0029	.0082
*6	do----	5.0	Silicified, light-gray, medium-grained country rock with abundant disseminated sulfides and scattered, earthy iron-oxide pods--	.01	.3	.015	.0063	.017
7	do----	5.0	Same description as sample 6, but less sulfide concentration----------------------	N	N	.0098	.0021	.0059
*8	do----	3.5	Outcrop of white to buff, bleached, fine-grained, sericitized, iron-oxide stained felsic igneous rock------------------------	N	.6	.012	.014	.0020

Data for samples shown in figure A-8--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
*9	Chip--	2.5	Same description as sample 8 in horsetailing zone--	N	0.1	0.0055	0.0021	0.0040

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* Samples used to calculate tonnage and grade.

1/ Additional analyses: sample 2 - Molybdenum, tungsten, = N; arsenic = 0.013%
sample 3 - Molybdenum = 0.0030%; tungsten, arsenic = N

CONCLUSIONS: This vein deposit contains a small, moderate- to low-grade, subeconomic gold and silver resource. At precious-metal prices of $400/oz gold and $10/oz silver, the average value of the resource is estimated to be $17/ton. The deposit is probably too small to mine alone; however, it could possibly be mined in combination with nearby properties. The assay values are significant and the deposit resembles other notable deposits in the vicinity: an unnamed prospect and the Dixie No. 2 (plate 1, nos. 31 and 32), and to the south, the SS No. 29 and the SS Nos. 17-19 prospects, north (plate 1, nos. 35 and 37). Further investigation may reveal additional gold and silver resources.

NAME: SS No. 29 prospect, north

OWNER: American Copper and Nickel Co.

INDEX MAP NO.: Plate 1, no. 35

LOCATION: SE1/4SW1/4 sec. 4, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,640 to 4,710 ft.

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 6.5 mi east on the four-wheel-drive Globe Mine Road, then 1/2 mi north on foot.

HISTORY: The early history of this property is not documented. It was probably developed concurrently with the SS Nos. 20-22, 27-29 mine, south (Star [?] mine) (plate 1, no. 38) in 1898-1915. Mr. H. Dankiness located the HML claims in the area in 1969, and Mr. George Warren and others have located various claims in the area since the late 1970's, but relative positions of the claim groups are not clear. Rioamax and Geodata, Inc. successively conducted intensive exploration programs in this area from the late-1960's. American Copper and Nickel Co. located the SS claim group in the area in 1977 and continued the exploration; the claims are still actively held.

GEOLOGY OF DEPOSIT: The deposit consists of a northeast-trending, northwest-dipping, 1- to 5-ft-thick zone of gray, white, or buff quartz and intensely bleached, silicified gneiss with some gouge and disseminated sulfides (fig. A-9). Associated with the main zone are a wide zone of alteration and, possibly, an intensely sericitized, intrusive felsic rock. The main zone crops out intermittently for approximately 190 ft. It is cut and offset by an east-trending fault at the portal of adit 2.

WORKINGS AND FACILITIES: Two adits, an open cut, and a pit are on the property (fig. A-9). Adit 1 has 115 ft of workings in two drifts, and adit 2 is 42 ft long with a 10-ft crosscut.

SAMPLING: One select, 1 random chip, and 14 chip samples were taken on the property. Sample localities are shown on figure A-9, and the analytical values are listed in the accompanying table. Ten samples contained detectable gold, values ranged from 0.01 to 0.21 oz/ton, and silver was detected in samples from throughout the property, values ranged from 0.2 to 3.5 oz/ton. Copper and lead analyses generally did not exceed 1 percent; one sample contained 1.39 percent copper. Small amounts of molybdenum and tungsten were also detected.

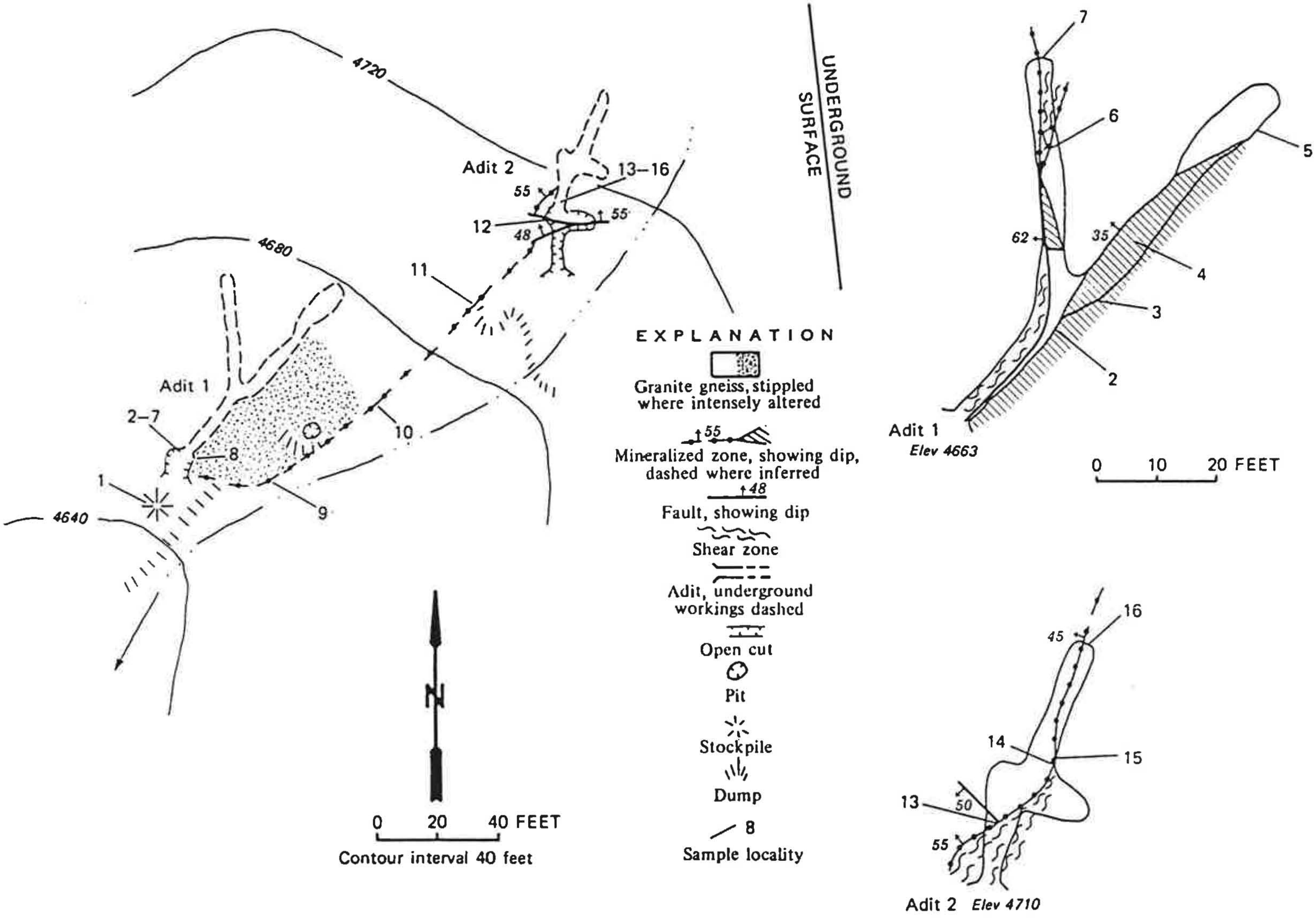

FIGURE A-9—Surface and underground maps, adits 1 and 2, SS No. 29 prospect, north

Data for samples shown in figure A-9

[N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Molybdenum (%)	Tungsten (%)
1/ 1	Select	NA	A 2-3 ton stockpile of gray, highly silicified gneiss with finely disseminated sulfides------------	0.06	1.5	0.032	0.062	0.0044	N
*2	Chip--	3.0	White to buff, quartz-rich, altered fractured gneiss-----------------	.02	2.6	.154	.48	.0023	0.0006
1/*3	do----	5.2	Punky to silicified, bleached rock with lenses of disseminated sulfides and iron-oxide stains----	.06	3.5	.057	.248	N	--
*4	do----	4.7	Fractured, white to buff quartz-rich gneiss with sulfides---------	.03	1.1	.096	.044	.0023	N
*5	do----	.9	do-------------------------------	.03	.6	.044	.055	.0037	N
1/ 6	do----	1.7	Multiple friable to silicified gouge stringers, up to 1 in. thick, with sulfides--------------------	N	.4	.022	.0096	N	--
1/ 7	do----	1.0	Disseminated sulfides in a 2-in.-thick gouge zone-----------------	N	.2	.060	.0021	N	.0220
*8	do----	3.5	White to buff, silicified gneiss---	.01	.5	.019	.052	.0023	.0010
1/*9	do----	1.0	Silicified zone with boxworks, iron-oxide along fractures, and bleached gneiss---------------------------	.02	.2	.096	.013	.0023	--

Data for samples shown in figure A-9--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Molybdenum (%)	Tungsten (%)
*10	Random chip--	NA	Over 6-8 ft zone of buff, iron-oxide stained gneiss with abundant quartz inclusions-----------------------	N	1.1	0.020	0.028	0.0023	--
1/*11	Chip--	4.0	Across silicified zone-------------	0.21	2.4	.051	.44	.0023	--
12	do----	2.5	Fault gouge and intensely sheared gneiss with limonite and secondary copper minerals------------------	N	1.1	1.39	.038	N	N
*13	do----	1.8	Friable, white to buff shear zone with less than 1 in. quartz veinlets-------------------------	.03	1.1	.020	.041	N	N
*14	do----	3.8	Silicified, bleached hanging wall above sample 15; some sulfides in gneiss---------------------------	.01	.9	.080	.063	N	N
*15	do----	.7	Friable, earthy hematite with minor specularite-----------------	N	.2	.28	.015	.0023	N
*16	do----	.8	White to brown, bleached, iron-oxide stained gneiss-------------------	N	.3	.24	.019	.0037	N

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* Samples used to calculate tonnage and grade.

1/ Sample analyzed for mercury, arsenic, antimony: none detected.

RESOURCE ESTIMATE: Between the portal of adit 1 and the workface of adit 2, the main structure is exposed for 190 ft along strike and 66 ft downdip. Based on eight samples taken on the structure (see sample table), it has an average thickness of 2.9 ft and contains an indicated resource of 3,000 tons at a weighted average grade of 0.05 oz/ton gold and 1.7 oz/ton silver. An inferred resource of 12,000 tons is determined by projecting the deposit an additional one-half of the strike length (190 ft / 2 = 95 ft) to the northeast, southwest and downdip. A tonnage factor of 12 ft^3/ton is used.

CONCLUSIONS: The deposit contains an identified subeconomic resource of 15,000 tons with a unit value ($400/oz gold and $10/oz silver) of $37/ton. The significant sample values, the prominence of the vein, and the similarity of the deposit to many other notable properties in the area suggest additional gold and silver resources may exist at depth. Persistent, anomalous molybdenum values are indicative of molybdenum resources at depth, but further work is needed to determine the type and extent.

NAME: SS Nos. 20-22, 27-29 mine, south (Star [?] mine)

OWNER: American Copper and Nickel Co.

INDEX MAP NO.: Plate 1, no. 38

LOCATION: E1/2NW1/4 sec. 9, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,480 to 4,760 ft.

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 6.5 mi east on the four-wheel-drive Globe Mine Road to the mine site.

HISTORY: USBM statistical files report the Star mine was operated by Ed Dolch of Victor, CA, in 1898 and by J. C. Turner of Victor, CA, in 1901. The property was owned by B. G. Thompson of Kelso, CA, in about 1914-15 (Wright and others, 1953, p. 58, tables). Mr. H. Dankiness located the HML claims in the area in 1969, and Mr. George Warren and others have located various claims in the area since the late 1970's, but the position of the claim groups is not clear. Rioamax and Geodata, Inc. successively conducted intensive exploration programs in this area from the late-1960's. American Copper and Nickel Co. located the SS claim group in the area in 1977 and continued the exploration; the claims are still actively held.

PRODUCTION: USBM statistical files record gold production of 7.26 oz in 1898 and 9.67 oz in 1901 from the Star mine. The raw ore production is not reported. Wright and others (1953) reported the shipment of a small tonnage of gold ore in 1914-15.

GEOLOGY OF DEPOSIT: Three prominent, subparallel quartz veins and several locally exposed quartz vein outcrops trend N. 50° to 70° E. and dip northwest or southeast in intensely altered gneiss and schist, in places partly or wholly replaced by quartz and sericite (fig. A-10). Quartz veins range from 0.6- to 8.0-ft-thick, are white to translucent gray, and are generally massive but in some places are brecciated. Iron-oxide stains are common, and some veins exhibit boxwork limonite pseudomorphs after pyrite, seams of calcite, and rare galena. The veins crop out discontinuously; inferred lengths of the three longest veins are 250 ft, 1,200 ft, and 1,350 ft. The vein systems are along probable fault-drag-induced fractures caused by the East Providence fault zone which passes through the east side of the property.

Rocks in the area consist predominantly of recrystallized potassium feldspar and quartz, albitized plagioclase, sericite, chlorite, and calcite. Rhyodacite dikes and plugs have intruded rocks very close to this deposit.

WORKINGS AND FACILITIES: Workings consist of 3 adits, 3 inclined shafts, a flooded shaft, a caved shaft, 2 trenches, 16 pits, and several open cuts leading to adit portals or shaft collars (figs. A-10 and A-11).

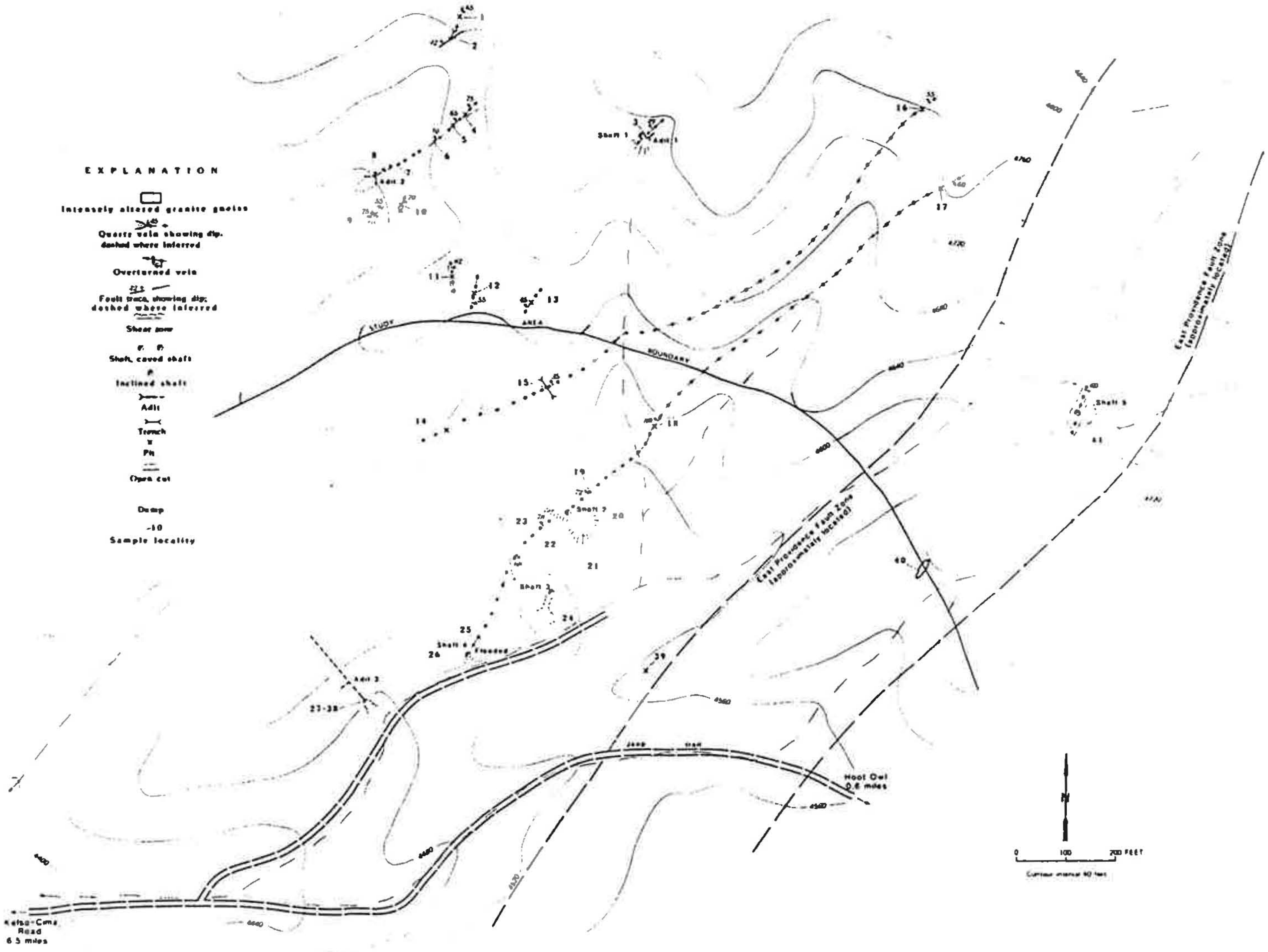

FIGURE A-10—Surface map, SS Nos. 20-22, 27-29 mine, south (Star [?] mine)

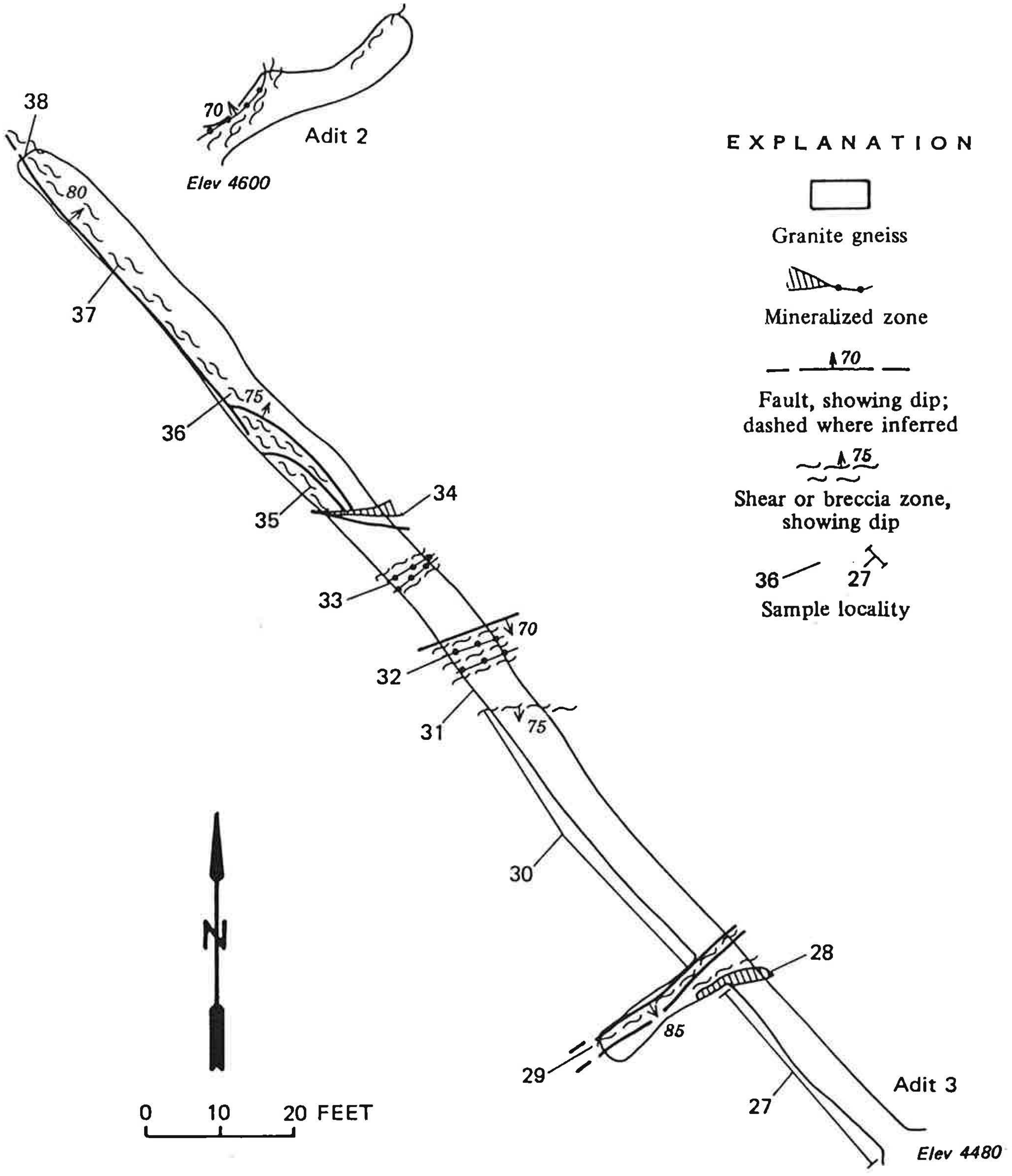

FIGURE A-11—Underground maps, adits 2 and 3, SS Nos. 20-22, 27-29 mine, south (Star [?] mine)

Data for samples shown in figures A-10 and A-11

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)	Tungsten (%)
No.	Type	Length (ft)	Description							
1	Chip--	1.2	A 1- to 1.5-ft-thick, iron-oxide stained quartz vein cuts silicified gneiss; minor limonite after pyrite--------------------	N	N	0.0072	0.0021	--	0.0200	--
2	do----	3.5	Up to 6-ft-thick quartz vein pinches at depth; cut by fault----------------------	N	N	.015	.028	--	.0023	--
3	do----	3.0	A 0.5-ft-thick quartz vein with boxwork structures and bleached, silicified, altered gneiss--------------------------	0.01	1.4	.098	.296	0.082	N	--
4	do----	1.6	Fracture zone and altered, silicified gneiss with boxwork----------------------	.01	1.5	.021	.124	--	--	--
5	do----	3.5	Silicified, bleached zone with sulfides and iron-oxide stains--------------------	N	.3	.016	.028	--	--	--
6	do----	3.5	do--	.06	1.6	.030	.095	.011	N	--
7	do----	3.0	do--	.03	.2	.0025	.016	--	--	--
8	do----	3.0	do--	N	.1	.026	.031	--	.0030	--
9	do----	1.3	Gray to buff, fine-grained, silicified rock with disseminated sulfides; podiform structure--------------------------------	.02	.4	.031	.112	--	.0044	--
10	Random chip--	NA	Across a 4-ft exposure of gray to buff, silicified rock with boxworks; quartz veinlets less than 1 in. thick-----------	N	.1	.0061	.012	--	.0051	--
11	Chip--	.6	Sinuous, white, iron-oxide stained quartz vein with boxworks; in shear zone which cuts sericitized gneiss------------------	N	N	.0010	N	.0004	N	N
12	do----	1.2	Pinch and swell quartz vein in gneiss; vein contains pyrite, limonite after pyrite, and iron-oxide stains------------	N	.084	.0025	.034	.0040	.0071	N
13	do----	3.2	Quartz-sericite zone with pyrite- and boxwork-bearing quartz veinlets----------	.02	1.9	.012	.083	.0067	N	N
14	do----	1.5	Red-to-yellow iron-oxide stained vein with minor sulfides is brecciated and recemented with silica----------------	Tr	N	.0064	.017	.066	.0098	N

Data for samples shown in figures A-10 and A-11--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)	Tungsten (%)
No.	Type	Length (ft)	Description							
15	Chip--	5.0	Alternating quartz veins and intensely sericitized, silicified gneiss------------	Tr	0.2	0.051	0.046	0.124	N	N
16	do----	2.2	Undulating zone 1.5- to 3-ft-thick of quartz breccia and veins and silicified, sericitized gneiss; abundant boxwork and minor malachite and azurite-----------	Tr	3.2	.239	.67	.097	0.02	N
17	do----	5.6	Fractured to slightly brecciated, white to red, iron-oxide stained quartz with gouge and sericitized gneiss--------------	N	.2	.0074	.083	.014	.02	N
18	do----	6.4	Gray quartz with disseminated sulfides; sulfur on dump---------------------------	Tr	.6	.061	.54	.021	.039	N
19	do----	5.5	White to buff quartz vein with boxwork and fine sulfides throughout--------------	.01	1.2	.0061	.31	.0028	.0017	N
20	Grab--	NA	Altered gneiss; no visible sulfides--------	N	N	.0120	.0420	.0350	.0077	N
21	do----	NA	Brown to gray, altered gneiss with minor disseminated sulfides---------------------	.06	1.8	.14	.33	.21	.0032	N
22	do----	NA	Yellow to white quartz with pyrite, iron oxides and sericite----------------------	N	.2	.0150	.0380	.0520	.0067	N
23	Chip--	8.0	Same description as sample 19--------------	N	.2	.0046	.0470	.0027	.0018	N
24	Grab--	NA	From top to bottom of 5.5-ft-thick dump; greenish, granite gneiss with disseminated sulfides and some siliceous veinlets------	N	.1	.0053	.0170	.0079	.0019	N
25	Chip--	5.0	Quartz breccia with minor disseminated sulfides and moderate red to yellow iron oxides------------------------------------	N	N	.0019	.0280	.0095	.0017	N
26	Grab--	NA	From dump; same description as sample 24---	N	N	.0130	.0480	.0480	.0088	N
27	Random chip--	NA	Through 45 ft of gray, fractured, moderately iron-oxide stained gneiss-----------------	.01	.2	.0540	.0780	.42	.0120	N
28	Chip--	2.5	Friable material from shear zone in gneiss contains secondary copper minerals--------	Tr	N	.0570	.0230	.63	.0022	--
29	do----	1.2	Across gouge and shear zone between faults	.01	N	.0130	.0260	.44	.0039	0.0006

Data for samples shown in figures A-10 and A-11--Continued

Sample				Gold	Silver	Copper	Lead	Zinc	Molybdenum	Tungsten
No.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)	(%)	(%)	(%)	(%)
30	Random chip--	NA	Across 43 ft of gneiss; fresh closer to portal, fractured and mineralized with disseminated pyrite and galena towards workface----------------------------------	N	N	0.0210	0.0690	0.14	0.0150	--
31	Chip--	7.0	Moderately fractured, altered gneiss with disseminated pyrite----------------------	N	N	.0460	.0550	.38	.0120	--
32	do----	5.5	Fault and shear zone contains pyrite and secondary copper minerals----------------	N	0.1	.23	.0490	1.2	.0053	N
33	do----	3.7	Silicified, pyrite-bearing, sulfur-stained gneiss with quartz stringers-------------	N	N	.0180	.0400	.17	.0062	N
34	do----	4.7	A 2.7-ft-thick brecciated quartz vein and a 2.0-ft-thick brecciated gneiss zone-----	N	.2	.0150	.47	.16	.0074	--
35	do----	4.6	Multiple shear and gouge zones------------	N	N	.0150	.0380	.0290	.0096	--
36	do----	4.0	Brown, brecciated to sheared zone with moderate disseminated pyrite-------------	N	N	.0093	.0190	.0083	.0050	N
37	do----	5.5	do--	N	N	.0120	.0340	.0140	.00160	N
38	do----	4.0	do--	N	N	.0100	.0360	.0140	.0077	N
39	Select	NA	Brown to buff, weathered, limonite-stained gneiss----------------------------------	0.01	.1	--	--	--	.0230	0.0010
40	Grab--	NA	White to buff, altered, brecciated quartz.	N	.2	--	--	--	.0130	.0010
41	Random chip--	NA	Brown to buff, intensely iron-oxide stained quartz vein through approximately 20-ft-wide zone of altered, sheared gneiss------	N	N	--	--	--	.0170	.0028
42	do----	NA	Outcrop 700 ft southeast of sample 40 is an 8- to 10-ft-thick, white to gray, iron-oxide-stained quartz vein that trends N. 30° E. and dips steeply southeast in siliceous quartz monzonite (?)------------	N	.052	.0020	.046	N	.0084	.0008

Adits range in length from 8 ft (no. 1) to 175 ft with a 20-ft drift (no. 3), and the inclined shafts range in depth from 10 ft (no. 1) to 40 ft (no. 2). Shaft 2 has a large dump which suggests a drift at depth.

SAMPLING: Thirty chip, 5 random chip, 6 grab, and a select sample were taken on the property. Sample locations are shown on figures A-10 and A-11 (sample 42 not shown), and the analyses are listed in the accompanying table. Of 16 samples with gold, 5 contained a trace, and 11 ranged from 0.01 to 0.06 oz/ton gold. Of 25 samples with silver, values ranged from 0.052 to 3.2 oz/ton; 7 contained more than 1.0 oz/ton silver. Of those samples analyzed for copper, values ranged from 0.0021 to 0.239 percent; lead values ranged from 0.0021 to 0.67 percent, and zinc values ranged from 0.0004 to 0.0028 percent in 5 of 26 samples analyzed.

The highest gold and silver values occur generally to the northwest close to the SS No. 29 and SS Nos. 17-19 prospects, north (plate 1, nos. 35 and 37); properties with significant gold and silver values. The higher base metal values are generally associated with the longer veins on the southeast which are closer to the East Providence fault zone.

CONCLUSIONS: Although significant gold and silver values are associated with the veins, the sample values are too erratic and scattered to estimate a resource. The analytical values of gold, silver, copper, lead, and zinc; the size of the veins; and the geologic setting indicate this system should be studied in detail. In addition, the alteration, the proximity to felsic intrusive dikes and plugs, and the anomalous analytical values of molybdenum describe an environment similar to the high-potassium, calc-alkaline molybdenum deposits (Westra and Keith, 1981, p. 852) of the stock, plutonic, or Climax type.

NAME: Globe mine

OWNER: Howard Blair

INDEX MAP NO.: Plate 1, no. 57

LOCATION: SE1/4SE1/4 sec. 9, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,840 to 5,140 ft.

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 7.0 mi east on the four-wheel-drive Globe Mine Road, then about 1/4 mi east on foot to the mine site.

HISTORY: The Globe mine was discovered and first located by Mr. Pearson about 1910 according to San Bernardino County records. The Barstow Printer (April 21, 1911) reported that the Globe Gold Mining Co. had developed 250 ft of "tunnel" and was still progressing. The property was reported idle by Tucker and Sampson (1930, p. 236; 1931, p. 296) who noted a 1,000 ft adit developed on seven claims owned by the Globe Gold Mining Co., George Thomas, President. Wright and others (1953, p. 35, tables) and Goodwin (1957, p. 633) reported the mine, owned at the time by Glenn Hollis, as idle. Howard Blair and others located the Beecher 1-3 claims on Dec. 21, 1979, and still held the property in 1982. These claims conflict with a portion of the SS claim block located by American Copper and Nickel Co. in 1977.

PRODUCTION: There are no documented production records known for the Globe mine; however, Tucker and Sampson (1930, p. 236; 1931, p. 296) noted, "Some very high-grade ore has been shipped from the property."

GEOLOGY OF DEPOSIT: The main deposit consists of a roughly tabular, pinch and swell zone of sheared and broken gneiss, fault gouge, quartz veins, and brecciated quartz and gneiss (figs. A-12 and A-13). The zone ranges from 1.0 to more than 10 ft thick and is exposed underground for 240 ft along strike and 275 ft downdip. Surface exposures are poor and ambiguous; however, manifestations probably relating to the main vein system are found 850 ft to the west (sample 75) and 650 ft to the east (sample 71).

Quartz ranges from white to dark blue gray, is commonly iron-oxide stained, and contains pyrite, limonite pseudomorphs after pyrite, and traces of galena, probable sphalerite, chalcopyrite, and specularite. Tan to brown calcite veinlets occur in fractured quartz and gneiss. Epidote and chlorite are common in zones of sheared or brecciated gneiss; hexahydrite (a hydrous magnesium sulfate) is a common weathering product from these zones. Possible wolframite was observed at two sample locations.

Several localized veins and mineralized zones are exposed in nearby surface outcrops (samples 69, 70, 72-74) and along the haulage (4,878 ft) level of the main shaft (samples 59, 60, 62, 64). At least two zones

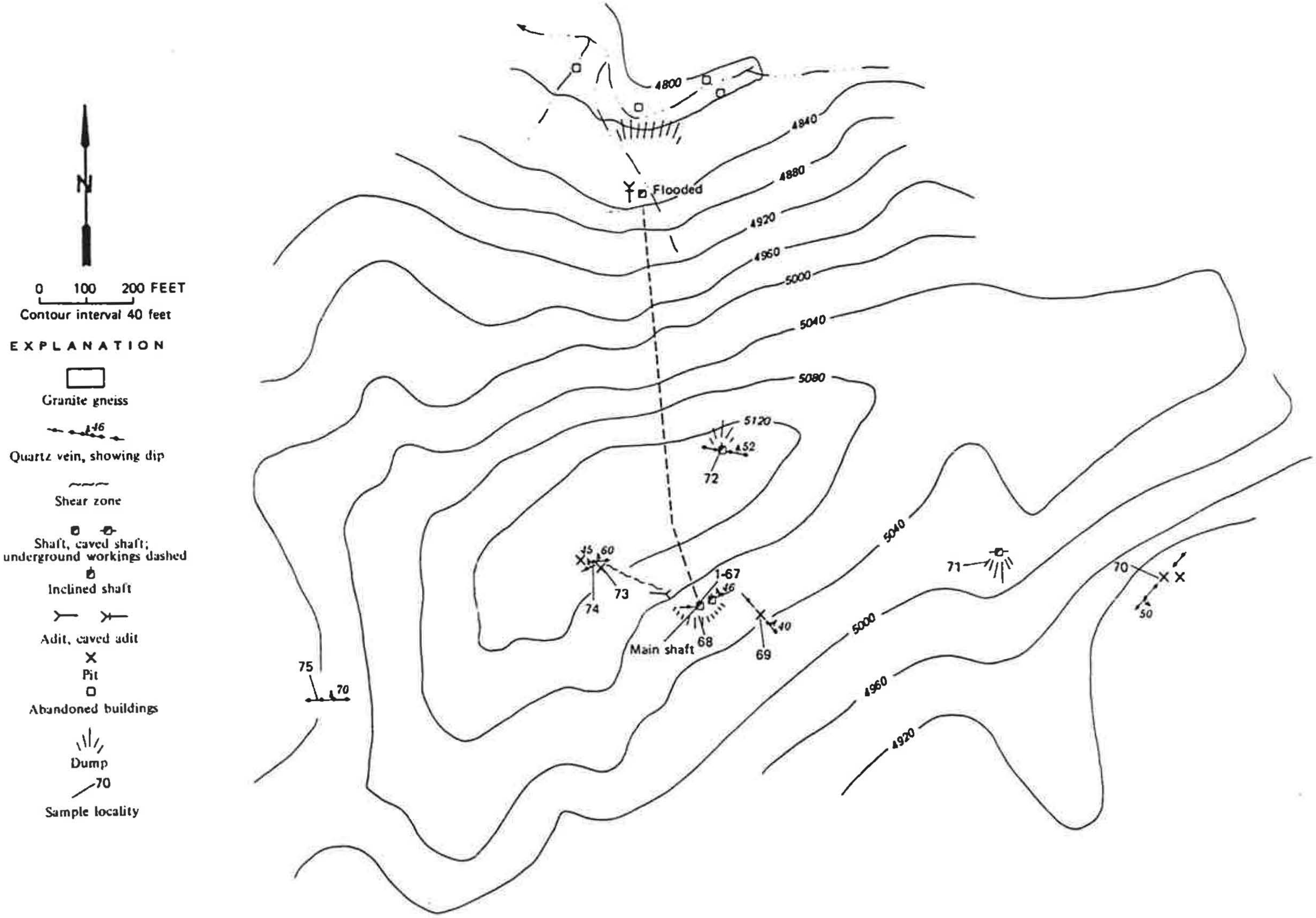

FIGURE A-12—Surface map, Globe mine

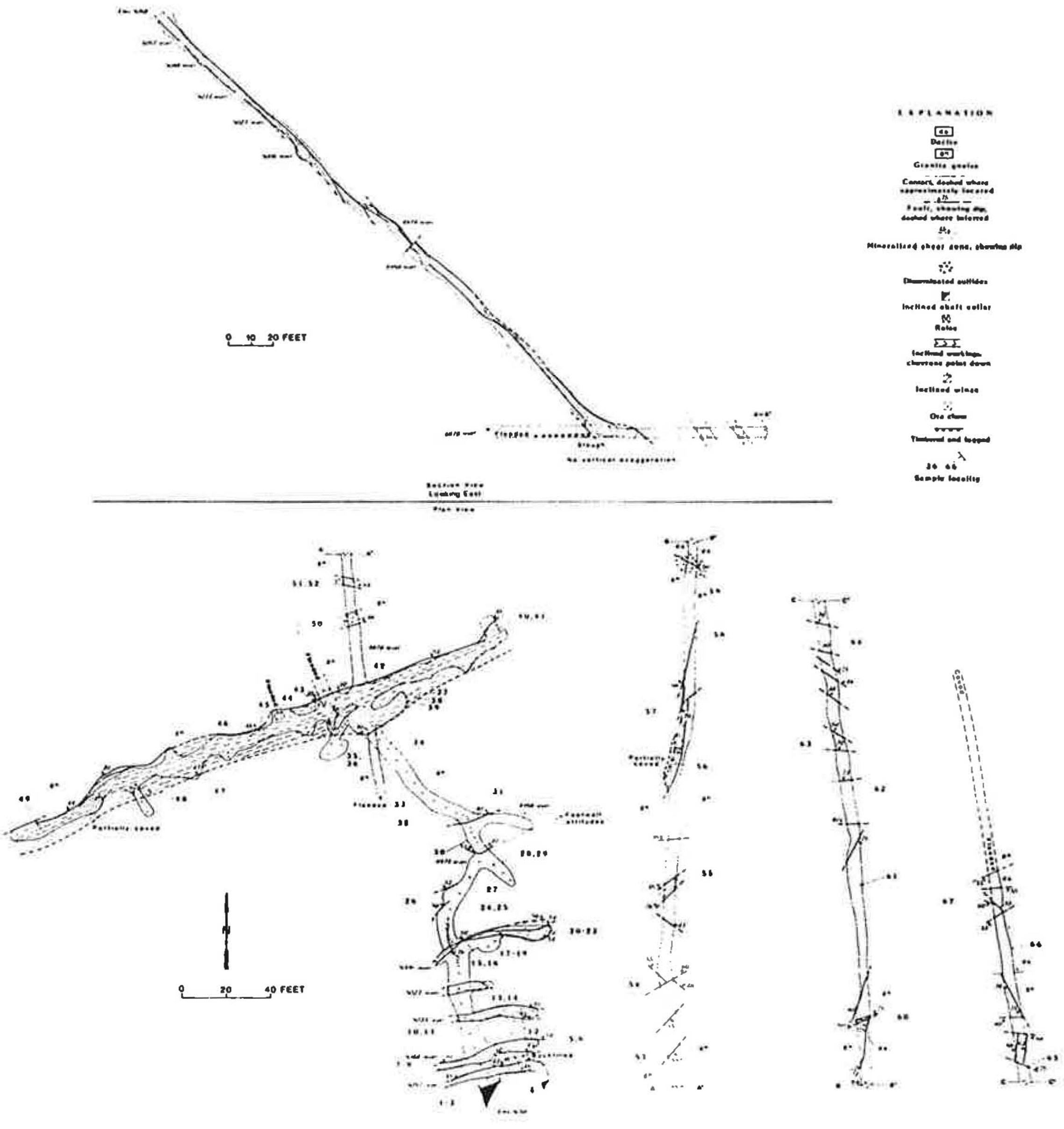

FIGURE A-13—Underground map and section view, Globe mine

Data for samples shown in figures A-12 and A-13

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
*1	Chip--	1.6	Bleached clay gouge in brecciated hanging wall; trace of pyrite and limonite--------------------------	0.01	0.1	0.0031	N	0.0300	0.0062
*2	do----	.9	Iron-oxide stained quartz vein with a trace of pyrite------------	.27	6.8	.0050	0.1000	.0310	.0330
*3	do----	3.5	Silicified and brecciated gneiss in footwall; minor limonite, local calcite veins, and chalcedony------	.60	1.7	.0019	.0360	.0410	.0089
*4	do----	2.5	Fractured to brecciated quartz------	.16	2.5	.0021	.0590	.0250	.0160
*5	do----	2.0	Fractured quartz and gneiss---------	.40	7.2	N	.1100	.0230	.0180
*6	do----	1.5	Fractured to brecciated gneiss in hanging wall----------------------	.11	2.0	.0049	.0420	.0500	.0120
*7	do----	7.0	Dark blue-gray quartz breccia clasts; internally fractured and iron-oxide stained---------------------------	.01	.6	.0088	.0320	.0560	.0130
*8	do----	1.8	Quartz breccia with some pyrite and calcite---------------------------	.03	1.1	.0029	.0190	.0200	.0110
9	do----	2.0	Gneissic footwall-------------------	N	.1	.0057	N	.0460	.0046

Data for samples shown in figures A-12 and A-13--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
*10	Chip--	1.3	Quartz breccia and vein below hanging wall----------------------	0.82	8.7	0.0031	0.058	0.036	0.0045
11	do----	2.5	Gneissic footwall------------------	N	N	.0005	.0038	.017	N
*12	do----	2.0	Across 1.5-ft quartz vein and 0.5 ft of gneissic footwall--------------	.02	1.6	.0016	.0260	.0300	.0110
13	do----	1.4	Brecciated gneiss with some silica and traces of pyrite--------------	N	.2	.0011	.0051	.0075	N
*14	do----	4.5	Across zone below breccia; veins, bands, and blebs of tan calcite with a few dark blue quartz veins; some pyrite, traces of galena, chalcopyrite, and limonite---------	.15	2.9	.0033	.081	.091	.0018
*15	do----	1.0	Breccia zone below hanging wall-----	.06	2.0	.0033	.029	.019	--
16	do----	5.0	Gneissic footwall------------------	N	N	.0041	.0038	.0070	N
*17	do----	1.0	Quartz breccia below hanging wall---	Tr	N	.0008	.0057	.0086	--
*18	do----	1.3	Brown, iron-oxide stained quartz----	.01	.9	.0011	.010	.017	--
*19	do----	2.0	Gneiss footwall with disseminated sulfides along fractures-----------	.06	.5	.0008	.014	.028	--

Data for samples shown in figures A-12 and A-13--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
*20	Chip--	2.0	Fractured to brecciated iron-oxide stained hanging wall with pink calcite--------------------------	0.03	0.5	0.0014	0.031	0.019	--
*21	do----	2.7	Iron-oxide stained quartz and gneiss breccia with trace pyrite----------	.01	N	.0019	.0077	.011	--
*22	do----	1.7	Gray quartz with dark blue stringers, pyrite and other sulfides; some brecciation-----------------------	.01	.5	.0026	.019	.013	--
23	do----	1.5	Fractured to brecciated gneiss------	N	N	.0017	.0038	.030	--
*24	do----	2.0	Cataclastic zone with gray-to-blue quartz clasts and pyrite in quartz and gouge------------------------	.01	.2	N	N	.0160	0.0073
25	do----	2.0	Gneissic footwall with about 1% pyrite---------------------------	N	N	N	N	.0180	.0143
26	do----	5.0	Sheared to fractured gneiss between two faults splitting from the main zone------------------------------	N	N	N	N	.0140	.0040
*27	do----	1.5	Soft, greenish-gray gouge and shear zone------------------------------	Tr	.3	.0016	N	.0190	.0055

Data for samples shown in figures A-12 and A-13--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
1/*28	Chip--	5.5	Cataclastic zone with fragments of quartz and silicified gneiss; traces of pyrite------------------	0.01	0.2	N	N	0.0180	0.0064
1/*29	do----	1.3	Gneiss footwall contains clear quartz veinlets, dark blue to black streaks, and 1%-2% pyrite----------	.01	.1	N	N	.0140	.0049
*30	do----	3.2	Breccia and gouge with quartz and gneiss fragments and calcite lenses.	.02	.5	N	N	.0220	.0052
*31	do----	3.2	do---------------------------------	.08	.8	0.0048	N	.0170	.0076
1/*32	do----	4.8	Breccia and shear with discontinuous quartz veins----------------------	N	.1	N	N	.0180	.0055
*33	do----	3.0	Sheared and brecciated gneiss with calcite veinlets and some quartz---	.02	N	N	N	.0200	.0045
1/*34	do----	5.4	Cataclastic zone with veinlets and blebs of calcite and quartz; quartz is blue-black and contains pyrite, chalcopyrite, and specularite------	.03	.9	.0027	N	.0400	.0066
*35	do----	4.5	Breccia zone with calcite and quartz stringers and disseminated sulfides.	.10	2.2	.0064	0.0450	.0830	.0083
*36	do----	4.5	do---------------------------------	Tr	.4	.0054	N	.0220	.0036

Data for samples shown in figures A-12 and A-13--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
1/*37	Chip--	2.0	Sheared and fractured hanging wall with 1% pyrite--------------------	0.01	0.1	N	N	0.0170	0.0040
1/*38	do----	3.0	Massive translucent to blue-black quartz replacement of breccia zone; 3% sulfides and some calcite lenses.	.01	.5	N	N	.0220	.0120
1/*39	do----	5.0	Fractured and brecciated gneiss with some blue-black quartz clasts and veinlets and calcite--------------	.02	.8	N	0.0220	.0400	.0051
*40	do----	4.0	Gray quartz vein and gneiss with quartz and calcite veinlets; sulfides in quartz and gneiss------	.01	N	N	.0170	.0120	.0084
*41	do----	2.0	Quartz vein and silicified breccia	.01	.1	N	.0190	.0290	.0065
1/*42	do----	4.0	Cataclastic zone with gouge and breccia---------------------------	.01	.1	N	N	.0190	.0060
1/*43	do----	4.8	From hanging wall down through brecciated quartz and gneiss-------	Tr	N	0.0013	N	.0180	.0058
*44	do----	3.8	Massive gray quartz vein and brecciated gneiss-----------------	.01	.4	N	.0210	.0190	.0130
*45	do----	3.7	Same description as sample 43-------	.01	.4	N	N	.0180	.0057

Data for samples shown in figures A-12 and A-13--Continued

Sample				Gold	Silver	Copper	Lead	Zinc	Molybdenum
No.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)	(%)	(%)	(%)
*46	Chip--	3.5	Gray-brown quartz breccia with abundant calcite, iron-oxide stringers and sulfides------------	0.01	0.2	0.0072	0.0150	0.0320	0.0034
1/*47	do----	7.0	Fault gouge, quartz and gneiss breccia with calcite veinlets and disseminated sulfides-------------	.07	3.4	.0020	.0320	.0380	.0100
*48	do----	5.5	Same description as sample 47 except abundant sulfides-----------------	.04	1.1	N	N	.0270	.0270
*49	do----	7.5	Fault gouge and brecciated quartz and gneiss with sulfides----------	Tr	.3	N	N	.0130	.0048
50	do----	4.0	Shear zone with calcite veinlets in gneiss-------------------------	N	.1	.0015	.0160	.0120	.0037
1/ 51	do----	5.0	Granitic rock, with traces of pyrite, above shear---------------	N	.1	N	N	.0120	.0045
1/ 52	do----	3.0	Shear zone with calcite and pyrite--	N	N	N	N	.0130	.0043
53	do----	3.0	Crosscutting structures with pyrite.	N	N	N	N	.0130	.0041
54	do----	2.0	do-------------------------------	N	N	.0018	.0710	.0510	.0160

Data for samples shown in figures A-12 and A-13--Continued

Sample										
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
1/ 55	Chip--	3.0	Shear zone with clay gouge in chloritically altered gneiss; traces calcite, epidote, pyrite, and limonite-------------------------	N	N	N	0.0160	0.0220	0.0048
56	do----	3.5	Iron-oxide stained shear zone in gneiss----------------------------	N	N	N	N	.0170	.0038
1/ 57	do----	1.8	Lens-shaped shear zone; same description as sample 55-----------	N	N	N	N	.0230	.0042
1/ 58	do----	1.0	Gouge zone in gneiss; quartz granules, and some comb quartz-----	N	N	0.0100	.0170	.0945	.0018
59	do----	2.5	Disseminated pyrite along contact between gneiss and volcanic rock---	Tr	0.1	N	N	.0160	.0035
1/ 60	do----	1.2	Reddish-orange clay in shear zone; chlorite, minor calcite, traces of pyrite and wolframite----------	Tr	N	.0099	.0490	.0870	.0031
61	do----	3.0	Traces of disseminated pyrite in massive gneiss--------------------	N	N	.0013	.0170	.0220	.0030
1/ 62	do----	.9	Quartz and gneiss breccia with calcite veinlets and disseminated sulfides-------------------------	0.01	.2	.0027	N	.0210	.0036

Data for samples shown in figures A-12 and A-13--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
63	Chip--	1.2	Iron oxides in fault gouge with abundant sulfides------------------	N	0.1	N	N	0.0150	0.0040
1/ 64	do----	1.5	Fine-grained sulfides in quartz and gneiss breccia---------------------	Tr	N	N	N	.0130	.0053
65	do----	0.9	Iron-oxide stained gouge with pyrite and 1-in.-thick quartz vein--------	N	N	N	N	.0150	.0040
1/ 66	Random chip--	NA	Through 20 ft of gray, aphanitic, siliceous rock (volcanic?) with abundant disseminated sulfides-----	N	N	N	N	.0080	.0032
1/ 67	Chip--	3.0	Iron-oxide stained gouge zone with abundant pyrite--------------------	N	N	N	N	.0100	.0053
68	Select	NA	Iron-oxide stained, gray-green-to-white quartz with disseminated sulfides, boxworks, and vugs-------	0.676	5.9	N	0.18	.06	--
69	Chip--	2.8	Across 4 in. of quartz vein, 8 in. of friable gouge and 1.8 ft of quartz and silica-rich gneiss------	.024	N	N	.03	.02	--
70	do----	2.2	Slightly silicified gouge and alteration zone in gneiss----------	.196	N	--	--	--	--

Data for samples shown in figures A-12 and A-13--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
71	Select	NA	From dump of collapsed shaft; iron-oxide stained quartz with minor sulfides and vugs	0.188	9.8	N	0.34	0.05	0.01
1/ 72	Chip	1.3	Translucent, gray-white quartz and a gouge zone in chloritically altered gneiss; quartz contains pyrite, limonite after pyrite, and boxwork	1.05	65.9	0.0096	.34	.13	.0055
73	Random chip	NA	Through 10 ft of gouge, shear zone and silicified gneiss below sample 74 and 7 ft of altered rock above sample 74	N	.4	N	.01	.02	--
74	Chip	.9	Massive, iron-oxide stained quartz vein	.024	.7	N	.01	.02	--
75	Random chip	NA	Across 10-ft-thick breccia and shear zone with quartz and gneiss clasts and coarse, crystalline calcite in vugs and fractures	N	.053	.0008	.0051	.0035	.0026

* Samples used to calculate tonnage and grade.

1/ Additional analyses:
All except sample 72 contained 0.02% to 0.04% tin.
Samples 29, 32, 34, 42, 62, 64, 66, 67, and 72 contained 0.0006% to 0.0014% tungsten.

exposed on this haulage level consist of altered felsic volcanic rock, probably dacite, which is composed of quartz, plagioclase, minor potassium feldspar, sericite, chlorite, calcite, and magnetite, and has fine pyrite in crosscutting quartz veinlets.

WORKINGS AND FACILITIES: Workings consist of the main northerly inclined shaft and haulage tunnel, three inclined shafts, a caved shaft, a 30-ft adit, a caved adit, and five pits (fig. A-12). The main inclined shaft (fig. A-13) consists of a 275-ft incline, about 400 ft of drifts and 100 ft of stopes on seven levels, more than 700 ft of crosscuts for haulage north to a partially collapsed adit and shaft, and an unknown length of crosscut south from the base of the incline. One or more flooded winzes from the 4,878-ft level connect with workings on lower levels. The main haulage way grades down to the flooded shaft, about 7 ft for each 100 ft of length. Four old building foundations and a small reservoir are at the north end of the workings.

SAMPLING: Seventy chip, 3 random chip, and 2 select samples were taken on the property. Sample locations are shown on figures A-12 and A-13, and the analyses are listed in the accompanying table. Fifty-one samples contained gold; values ranged from a trace to 1.05 oz/ton. Eight contained a trace, and 12 contained at least 0.1 oz/ton gold. Fifty samples contained from 0.053 to 65.9 oz/ton silver; only 16 samples exceeded 1.0 oz/ton silver. No samples exceeded 1 percent copper, lead, zinc, molybdenum, tin, or tungsten. Zinc and lead values were the highest and most common of the base metals; however, many samples also contained molybdenum and tin.

RESOURCE ESTIMATE: There are 30,000 tons of indicated and 80,000 tons of inferred resources with a weighted average grade of 0.05 oz/ton gold and 1.0 oz/ton silver. The indicated resource includes an irregular-shaped block 235 ft long by 310 ft downdip from the surface to 35 ft below the main drift at the haulage level. The inferred block is approximately 470 ft long and 550 ft downdip from the surface. The vein averages 5.0 ft thick; a tonnage factor of 12 ft^3/ton was used to calculate tonnage. Calculations are based on 43 samples (see sample list) taken from 27 sites.

Although the strike length could be as long as 1,500 ft if samples 71 and 75 were assumed to be on the structure, only the exposed dimensions in the main underground working were used to calculate resources because of the uncertainty. The distribution of high gold and silver values suggests that pay shoots may be present. More sampling would be needed to define the higher grade zones.

CONCLUSIONS: A subecononic resource of 110,000 tons is identified at this property. Based on precious-metal values of $400/oz gold and $10/oz silver, the deposit has an estimated unit value of $30/ton. As with many other nearby properties, mineralized zones are structurally controlled and precious-metal values appear to be genetically associated with felsic volcanic rocks. The geologic setting, the significant metal values, and the presence of similar deposits in the vicinity suggest additional gold and silver resources may be present at depth. The presence of anomalous molybdenum in this and nearby deposits suggests molybdenum resources at depth, but further work is needed to determine the type and extent.

NAME: Frisco No. 3 mine

INDEX MAP NO.: Plate 1, no. 64

LOCATION: NE1/4NW1/4 sec. 16, T. 11 N., R. 14 E., S.B.M. This property lies within a State grant section which is included in the study area.

ELEVATION: 4,840 to 5,080 ft.

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 6.5 mi east on the four-wheel-drive Globe Mine Road, then 1.5 mi south on the road to Summit Spring; mine is 1/2 mi northeast of Summit Spring on foot.

HISTORY: The Hornsilver and Silver Bell claims were located by Messrs. Domingo and Lopez, respectively, about 1904. The property was relocated by Russell Cooke in 1922. The mine was described by Tucker and Sampson (1930, p. 235; 1931, p. 295-296), Eric (1948, p. 305) and Wright and others (1953, p. 35, tables) as the Frisco No. 3, owned and operated by P. Thebadeau of Kelso, CA, about 1930-31 (see also Frisco No. 1 prospect and Double H Nos. 1 and 2, plate 1, nos. 51 and 69).

PRODUCTION: Production from this property is uncertain; however, Tucker and Sampson (1930, p. 235; 1931, p. 295-296) and USBM statistical files reported 1 ton, containing 2.17 oz gold and 55.4 oz silver, produced from the Frisco No. 3 in 1930. Based on the description and grade, it probably came from the Hornsilver (adit 4) vein.

GEOLOGY OF DEPOSIT: Two vein systems on this property are named the Silver Bell and the Hornsilver after the original claims. The main deposit occurs on the Silver Bell as a quartz vein and silicified shear zone which strikes N. 50° to 70° W. and dips 45° to 75° NE. in gneiss and intensely altered, silicified rock (fig. A-14). This vein system is exposed for approximately 500 ft along strike, ranges from 1 to 5.5 ft thick, and has a minimum vertical exposure of 155 ft. Quartz is commonly white to gray, iron-oxide stained, and massive to brecciated. Comb structures are rare.

On the Hornsilver vein, over the top of the ridge to the southeast from the Silver Bell, a north-northwest-trending, 25° to 42° NE. dipping quartz vein is in intensely altered rock near a contact with gneiss (adit 2, fig. A-14). The vein and associated alteration zone are exposed for only 55 ft along strike. The vein system is intensely sericitized and mineralized through a thickness of 20 ft near the portal. The altered rock at both the Silver Bell and the Hornsilver is composed of subequal amounts of quartz and potassium feldspar as well as sericite, iron oxides, jarosite, and traces of zircon and monazite. Volcanic venting related to several outcrops of probably Cretaceous age felsic intrusive rocks and breccias (fig. 2) is suspected as the common source because of the similarity of alteration and rock type.

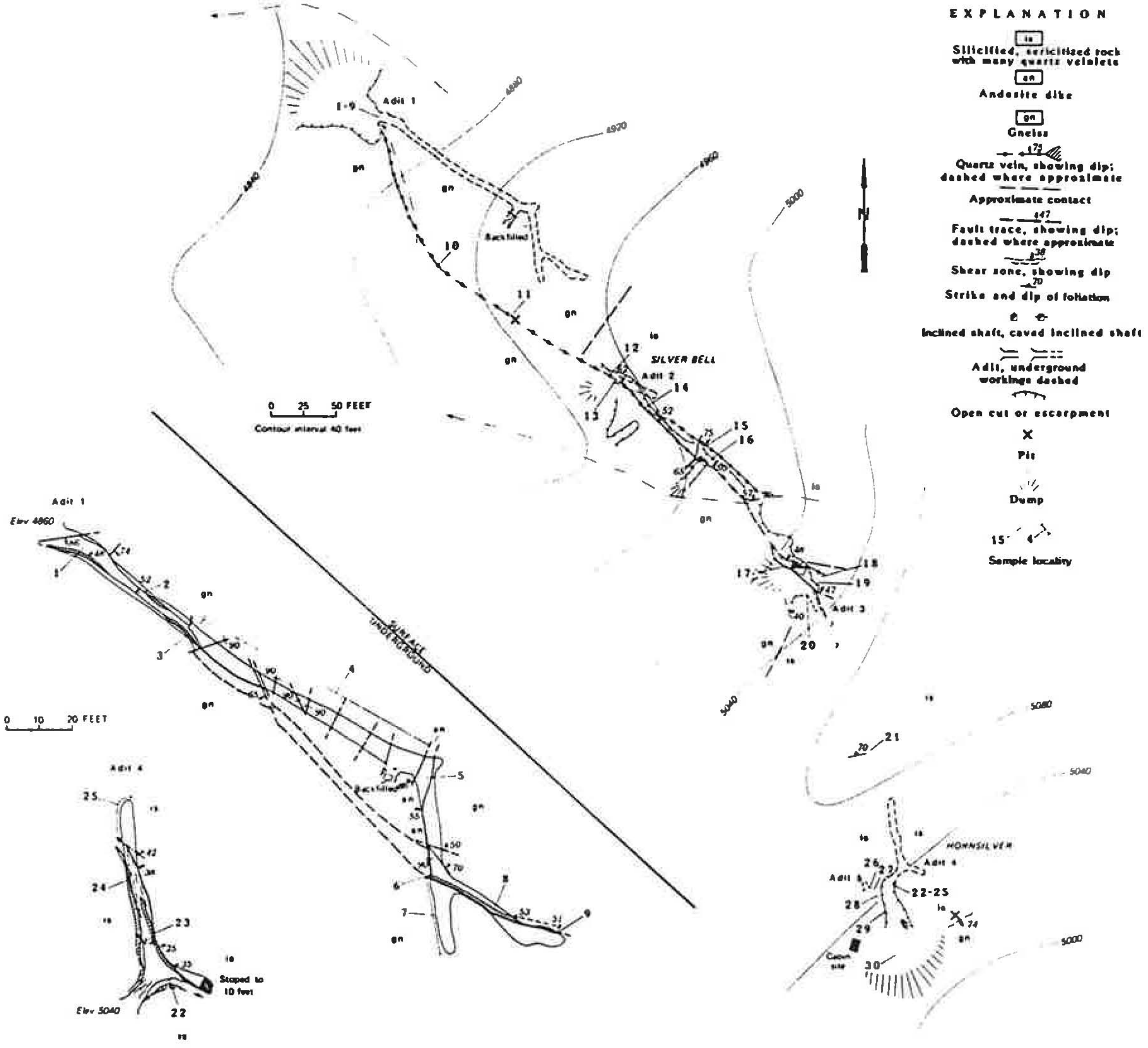

FIGURE A-14—Surface map, Frisco No. 3 mine, and underground maps, adits 1 and 4

Data for samples shown in figure A-14

[N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
*1	Chip--	6.0	Gouge and bleached, sheared gneiss with two 2-3 in. gray-white quartz veins------------------------------	0.001	0.25	0.0014	N	0.0110	0.0080
*2	do----	1.1	Limonite-stained gouge--------------	.002	.13	.0031	0.0400	.0160	.0043
*3	do----	2.5	Gray to white quartz vein 1.5 ft thick and iron-oxide banded gouge zone 1.0 ft thick-----------------	.001	.16	N	.0280	.0094	.0039
4	Random chip--	NA	Through 80 ft of slightly iron-oxide stained gneiss--------------------	N	N	N	N	.0082	N
5	Chip--	3.7	Fine-grained, intermediate to mafic composition dike is punky to massive and has a 4-in.-thick felsic zone--	N	.02	.0013	N	.0068	N
*6	do----	1.0	Comb quartz and brecciated quartz with 2%-3% sulfides--------------------	.017	.60	N	.0064	.0012	.0008
7	Random chip--	NA	Through 24 ft of gneiss with iron-oxide along fractures--------------	N	N	N	N	.0065	N
*8	Chip--	2.9	Siliceous gouge and gneiss with 1.7 ft of massive-to-fractured quartz and comb quartz-------------------	.005	.19	.0043	N	.0058	.0011

Data for samples shown in figure A-14--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
*9	Chip--	0.7	Fine quartz breccia in green gouge, massive gray quartz with black stringers of 5%-10% sulfides and gouge----------------------------	0.019	0.34	0.0055	N	0.0110	0.0019
*10	do----	1.0	White, fractured to brecciated quartz vein-----------------------	.005	.13	.0018	N	.0720	.0054
*11	do----	.9	White quartz with iron-oxide in fractures-------------------------	.001	.04	N	N	.0045	.0017
*12	do----	1.5	White, massive to comb quartz with iron-oxide stains-----------------	.014	.12	.0015	N	.0230	.0033
*13	do----	4.2	Fine grained quartz breccia, banded gouge, and intensely bleached, slightly silicified gneiss---------	.006	.20	N	N	.0200	.0022
*14	do----	4.0	Quartz vein and silicified gouge with minor comb quartz in gouge---------	.015	.29	.0011	0.1200	.0062	.0030
*15	do----	2.0	Iron-oxide stained quartz vein splinter---------------------------	.07	6.0	.0021	1.6	.0170	.0045
*16	do----	5.5	Red to orange iron-oxide stained, massive to comb quartz vein in bleached gneiss with quartz veinlets	.007	.40	N	.0320	.0140	.0042

Data for samples shown in figure A-14--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
*17	Chip--	4.0	Silicified, bleached gneiss, 4-in.-thick quartz vein, and gray-green gouge with quartz breccia----------	0.053	0.60	N	0.1200	0.0027	N
18	do----	6.0	Altered rock composed of quartz, potassium feldspar, sericite, and jarosite with quartz veins and lenses; zone widens and splits-----	N	N	N	N	.0013	N
19	do----	6.0	Continuation of sample 18-----------	N	.003	N	N	.0050	N
20	do----	4.7	Continuation of sample 19-----------	.005	.60	N	.0670	N	N
21	Random chip--	NA	Altered potassium feldspar and quartz with biotite along silicified, resistant ridge; clay, limonite after pyrite, sericite alteration; some clear quartz in intensely altered zones------------------------------	N	N	0.0020	.0043	.0026	0.0006
22	Chip--	5.0	Punky to intensely silicified felsic rock with reddish quartz veinlets--	N	.4	N	.01	.02	--
23	do----	4.8	Discontinuous quartz and white, friable, iron-oxide stained felsic rock-------------------------------	.046	2.8	.01	.17	.04	--

Data for samples shown in figure A-14--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
24	Chip--	3.0	Quartz and quartz breccia 1.0 ft thick and gouge zone 2.0 ft thick with quartz veinlets--------------	0.058	4.0	N	0.15	0.06	--
25	Random chip--	NA	Through 12 ft of bleached, iron-oxide-stained, white to gray-brown, medium-grained rock with pods of gray to white quartz---------------------	.196	11.8	N	.16	.1	--
26	Chip--	5.5	Across bleached rock and gouge and fractured to brecciated quartz veins; samples 26-29 in sequence across structure------------------------	.116	.3	N	.08	.02	--
27	do----	4.5	White to gray, medium-grained, siliceous rock with green to purple alteration and iron-oxide-stained quartz stringers------------------	N	2.0	N	.08	.02	--
28	do----	6.0	do--------------------------------	.024	2.2	N	.14	.02	--
29	do----	3.1	White-to-orange, massive quartz vein	.020	.8	N	.28	.02	--
30	Grab--	NA	White to yellow, bleached siliceous igneous and gneiss rock with some red iron-oxide bands and minor boxwork--------------------------	.038	3.8	N	.21	.03	--

* Samples used to calculate tonnage and grade.

WORKINGS AND FACILITIES: Workings consist of five adits (5 ft, 15 ft, 35 ft, 84 ft, and 235 ft long), two shallow inclined shafts, a caved inclined shaft, two pits and several open cuts (fig. A-14).

SAMPLING: One grab, 4 random chip, and 25 chip samples were taken from the property. Sample locations are shown on figure A-14, and analyses are listed in the accompanying table. Twenty of the samples were taken across the Silver Bell vein or adjacent country rock. Fifteen samples across the vein contained gold and silver. Gold ranged from 0.001 to 0.07 oz/ton, and silver ranged from 0.04 to 6.0 oz/ton. Only one sample from the Silver Bell vein exceeded 0.6 oz/ton silver. No gold or silver were detected in one sample of silicified, sericitized gneiss (?) from the ridge top. Of nine samples of quartz or intensely altered rock from the Hornsilver vein, seven contained gold, and all contained silver; values ranged from 0.020 to 0.196 oz/ton gold and 0.3 to 11.8 oz/ton silver. The highest values on the Hornsilver vein came from intensely altered rock at the work face of adit 4. Generally low levels of copper, lead, zinc, and molybdenum were detected in samples throughout the system. One sample contained 1.2 percent lead, and eight samples contained from 0.12 to 0.28 percent lead. Lead and zinc values were slightly higher on the Hornsilver vein than on the Silver Bell vein.

RESOURCE ESTIMATE: The exposed portion of the Hornsilver vein is too small for a resource calculation. Although sample values on the Silver Bell vein are lower, there is sufficient size and grade to warrant a tonnage estimate. An indicated block of 2,000 tons of resources at a weighted average grade of 0.006 oz/ton gold and 0.2 oz/ton silver is estimated in the vicinity of adit 1. The block averages 2 ft thick, is estimated to be 235 ft long, and projects 20 ft downdip and upwards to the surface. A resource block of 38,000 tons at a weighted average grade of 0.022 oz/ton gold, and 0.7 oz/ton silver is inferred for the remainder of the vein. The inferred resource block continues 250 ft downdip from the indicated resource block or the surface, is inferred to extend 80 ft northwest, and averages 2.7 ft thick. A 100-ft-long segment in the vicinity of samples 15 and 16 is doubled because the vein splits into two parts. A tonnage factor of 12 ft^3/ton is used.

CONCLUSIONS: The deposit is estimated to contain an identified resource of 40,000 tons at an average grade of 0.021 oz/ton gold and 0.7 oz/ton silver for a total unit value ($400/oz gold and $10/oz silver) of approximately $15/ton. The deposit is subeconomic but exhibits many positive qualities, including possible size, significant grades, and intense alteration. This property warrants further investigation for additional gold and silver resources at depth with possible byproduct lead. Although the Silver Bell and Hornsilver veins are not observed to be continuous, their similarity in character and their association with the silicified, sericitically altered rock unit suggest a genetic association. Further investigation is needed to determine if a larger deposit is present.

NAME: Double H Nos. 1 and 2 mine

INDEX MAP NO.: Plate 1, no. 69

LOCATION: SW1/4NE1/4 sec. 16, T. 11 N, R. 14 E., S.B.M. This property lies within a State grant section which is included in the study area.

ELEVATION: 4,755 to 4,926 ft.

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 6.5 mi east on the four-wheel-drive Globe Mine Road, then 1.5 mi south on the road to Summit Spring; the mine is 1,600 ft northeast of Summit Spring on foot.

HISTORY: The early history of the property is unknown. Described by Tucker and Sampson (1930, p. 235; 1931, p. 295-296), Eric (1948, p. 305) and Wright and others (1953, p. 35, tables) as the Frisco No. 5, owned and operated by P. Thebadeau of Kelso, CA, about 1930-31. A claim notice indicates that the Double H Nos. 1 and 2 were located by E. C. Herndon and G. B. Hallis in December 1948.

PRODUCTION: USBM statistical files record 105 dry tons produced from a "100 ft shaft and tunnel" on the "Frisco" in 1931. Recovery consisted of 42 oz gold and 329 lb copper at grades of 0.4 oz/ton gold and 0.16 percent copper. It is assumed that the production came from these workings.

GEOLOGY OF DEPOSIT: The deposit is a 1- to 3-ft-thick quartz vein and a siliceous, altered shear zone in deeply weathered, iron-oxide stained granite gneiss (fig. A-15). The N. 50° to 60° W. striking, 45° to 75° NE. dipping, tabular structure crops out for approximately 1,000 ft, and has a vertical exposure of 170 ft. The quartz is white to gray, exhibits massive to comb structure, and contains disseminated pyrite, galena, sphalerite, and minor chalcopyrite.

WORKINGS AND FACILITIES: Workings include two pits, a 50-ft-long open cut, three adits, and an inclined shaft (fig. A-15). Adit 1 is caved, adit 2 is caved at 45 ft, and adit 3 is 90 ft long. The inclined shaft is not accessible below 40 ft but appears to steepen and may contain drifts.

SAMPLING: Eight chip and three select samples were taken. Sample locations are shown on figure A-15, and the analyses are listed in the accompanying table. Gold was detected in nine samples; values ranged from 0.006 to 0.268 oz/ton and averaged 0.063 oz/ton. Silver, detected in all samples, ranged from 0.5 to 44.4 oz/ton and averaged 8.2 oz/ton. Only four samples exceeded 5 oz/ton silver. Lead values ranged from 0.01 to 1.2 percent, and zinc values ranged from 0.02 to 0.3 percent.

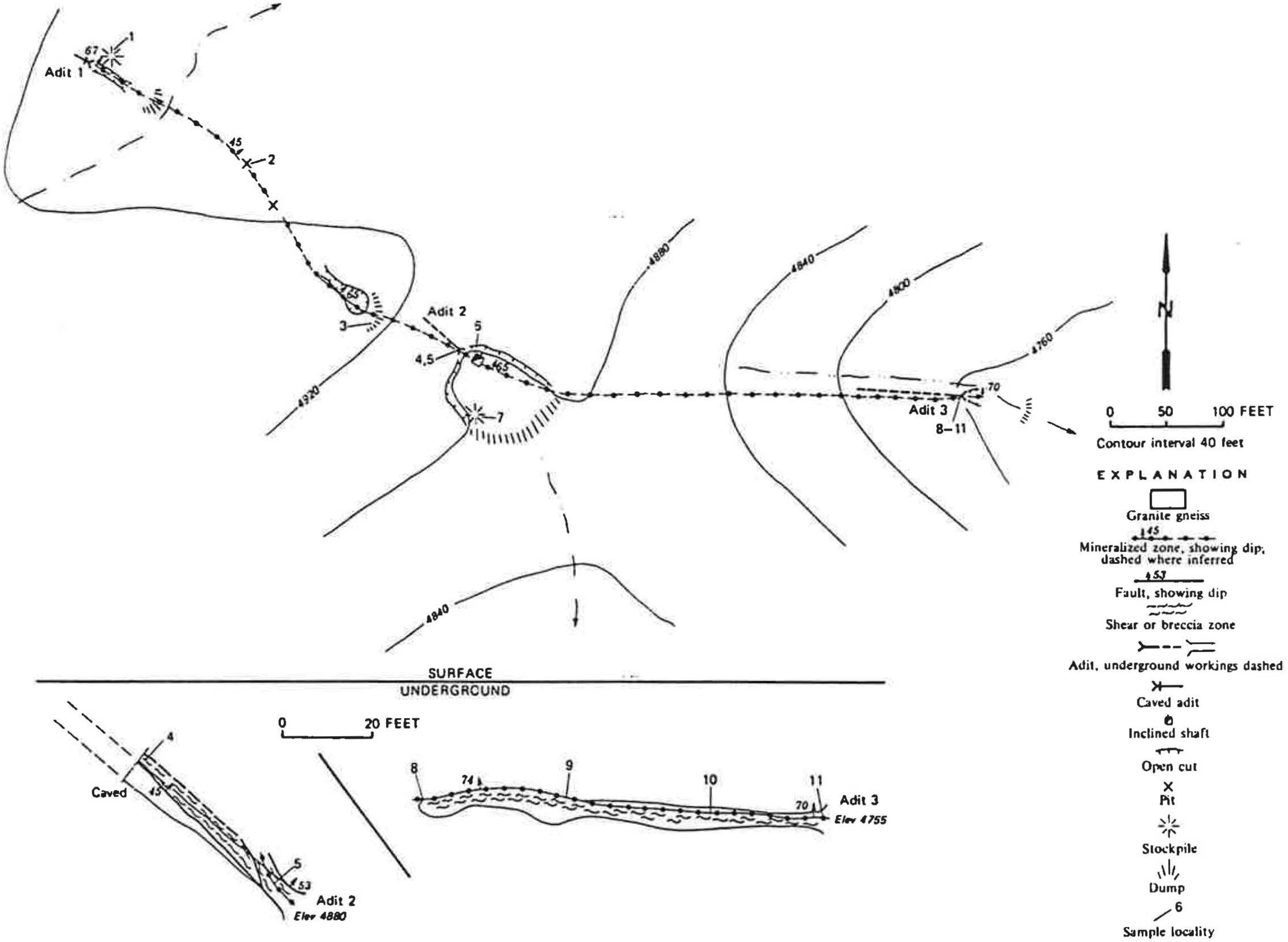

FIGURE A-15–Surface map, Double H Nos. 1 and 2 mine, and underground maps of adits 2 and 3

Data for samples shown in figure A-15

[N, none detected; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
1	Select	NA	White to gray quartz with pyrite and galena from stockpile of caved adit---------------	0.076	6.4	N	0.07	0.04
*2	Chip--	1.2	Quartz-rich, iron-oxide stained, tabular veinlwith minor country rock included------	.016	2.9	N	.03	.05
3	Select	NA	White quartz with pyrite, chalcopyrite, and galena on dump; pit is in white to gray, iron-oxide stained, sheared gneiss---------	.268	44.4	0.01	1.2	.07
*4	Chip--	1.6	Siliceous altered gouge and 1.3 ft of gouge and altered, punky country rock------------	N	.5	N	.01	.02
*5	do----	1.3	Iron-oxide stained comb quartz with brecciated gneissic country rock-----------	.066	8.5	N	.16	.14
*6	do----	3.0	Iron-oxide stained, sheared country rock----	N	.5	N	.01	.05
7	Select	NA	Gray to nearly opaque quartz with abundant pyrite---------------------------------------	.130	16.6	N	.55	.30
*8	Chip--	.5	Mixed quartz and country rock in shear zone with minor sulfide minerals; quartz occurs as two veinlets, each approximately 1 in. thick--	.046	2.5	N	.02	.02

Data for samples shown in figure A-15--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
*9	Chip--	1.0	Through punky iron-oxide stained gouge at structural swell with possible quartz breccia-------------------------------------	0.006	0.5	N	0.01	0.02
*10	do----	.8	Fault gouge and quartz in three veinlets 0.25 to 1 in. thick. Country rock is fractured and contains disseminated pyrite.	.040	3.5	N	.05	.03
*11	do----	1.5	Across broad undefined shear zone at portal with one prominent 2-in. quartz vein; pyrite and other sulfides noted--------------------	.044	3.6	N	.09	.04

---

* Samples used to calculate tonnage and grade.

RESOURCE ESTIMATE: The mineralized structure contains 45,000 tons of inferred resources at a weighted average grade of 2.5 oz/ton silver and 0.02 oz/ton gold. The estimate is based on an observed strike length of 880 ft, an average thickness of 1.4 ft, and a downdip projection of 440 ft. A tonnage factor of 12 ft^3/ton is used.

CONCLUSIONS: The deposit contains an identified subeconomic resource of gold and silver with byproduct lead and zinc. At a gold value of $400/oz and a silver value of $10/oz, the unit value of the deposit is about $33/ton. The structure may continue to the northwest or the southeast, but no evidence was observed. Based on the past production, prominence of the structure, grade of select samples, and other gold and silver properties in the vicinity, further investigation may reveal additional gold and silver resources with possible byproduct copper, lead, and zinc resources at depth.

NAME: Providence mine

OWNER: Piute Canyon Mines, Inc.

INDEX MAP NO.: Plate 1, no. 72

LOCATION: NW1/4SW1/4 sec. 16, T. 11 N., R. 14 E., S.B.M. This property lies within a State grant section which is included in the study area.

ELEVATION: 4,780 to 4,820 ft

ACCESS: From Kelso, CA, 4.0 mi northeast on the Kelso-Cima Road to Hayden Siding, then 6.5 mi east on the four-wheel-drive Globe Mine Road, then 1.5 mi south on the road to Summit Spring, then approximately 500 ft on foot.

HISTORY: The earliest San Bernardino County mining claim record on the property refers to the Grey Hound claim located by J.A. Domingo in February, 1900; however, Leech (1890, p. 105) cites minor production from a "Grey Hound" in 1889. The property was again located as the Grey Hound in 1910; mining activity in 1918 (USBM statistical files) and 1922 (Barstow Printer, Dec. 14, 1922) is attributed to the Providence Mine. Later literature cites Pete Thibedeau as the claim owner (Tucker and Sampson, 1930, p. 281-282; 1931, p. 354; Eric, 1948, p. 315; Wright and others, 1953, p. 82 tables; Goodwin, 1957, p. 661). Piute Canyon Mines, Inc. located the Gan 2-3 claims in March 1981.

PRODUCTION: Leech (1890, p. 105) reported $85 (approximately 4.1 oz) of gold produced by the "Grey Hound" in 1889. USBM statistical files show 12 tons from the Providence mine smelted in 1918. Recovery included 445 oz silver, 166 lb copper, and 2,465 lb lead at rates of 37 oz/ton silver, 0.7 percent copper and 10.3 percent lead.

GEOLOGY OF DEPOSIT: The deposit (fig. A-16) consists of a 35-ft-thick zone of brecciated and cemented Paleozoic limestone in fault contact on the east with granite gneiss along the north-northeast-striking East Providence fault (Hazzard, 1954). A fault exposed in the crosscut and along the 117-ft drift apparently marks the western boundary of the deposit. The fault-bound relationship is similar on a smaller scale to that at the Bonanza King mine (plate 1, no. 146).

The limestone breccia consists of reddish-brown to gray, finely to coarsely brecciated limestone in a hard, aphanic, limey matrix. Karst cavities are developed near the center of the zone. The east boundary fault is 2 to 8 ft thick and composed of incompetent, sheared and brecciated rock. The west fault is approximately 55 ft thick and composed of sheared carbonaceous shale, limestone, and silicified metasediments.

WORKINGS AND FACILITIES: The main accessible working is a 224-ft-long adit (fig. A-16) consisting of an 85-ft crosscut, a 117-ft drift, and two short drifts (8 and 14 ft long). Two shafts, one measured to a depth of

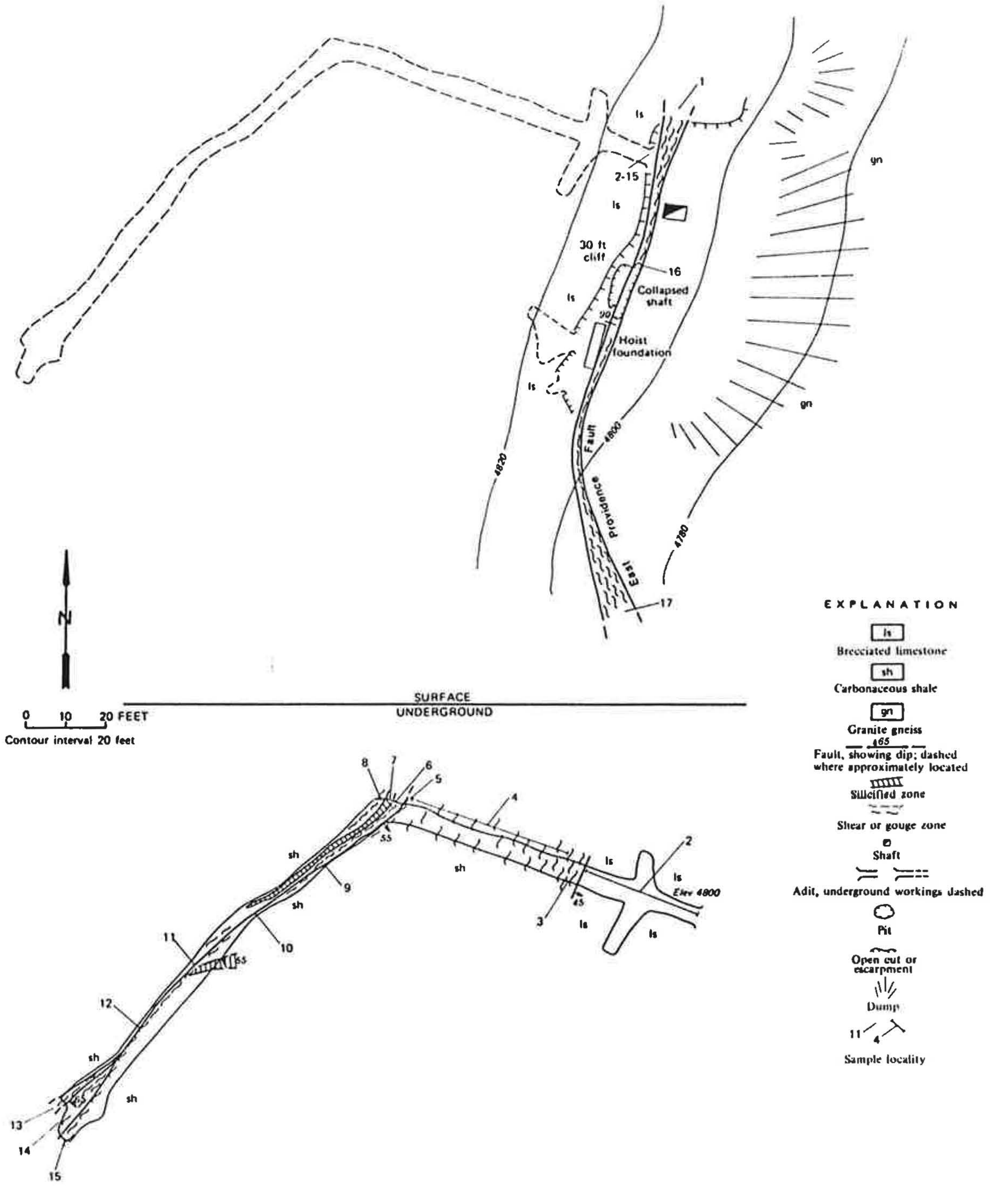

FIGURE A-16—Surface and underground maps, Providence mine

Data for samples shown in figure A-16

[N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold	Silver	Lead
No.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)
1/ 1	Chip--	6.2	Sheared metaigneous rock, limestone, and some gouge----	0.010	0.7	0.01
2	Random chip--	NA	Through 30 ft of brecciated limestone with a fine-grained matrix---	N	1.0	.06
3	Chip--	5.0	Contorted to sheared and brecciated metasedimentary rock.	.010	.3	N
4	Random chip--	NA	Through 43 ft of black carbonaceous shale with minor shear zones---	N	N	N
5	Chip--	1.6	Fractured to brecciated, gray shale with fragments of fine-grained, siliceous rock-------------------------	N	N	N
6	do----	2.2	White to orange fault breccia with soft, white clay matrix---	N	N	N
7	do----	1.3	Reddish to dark-brown, medium-grained, equigranular, siliceous, metasedimentary rock along fault plane-----	N	N	N
8	do----	2.0	Alternating layers of clay and dike rock---------------	N	N	N
9	do----	5.0	Across carbonaceous shale, a breccia zone with a clay stringer, and a sheared shale with siliceous rock-----	N	N	N
1/ 10	do----	3.0	Breccia zones with clay stringer----------------------	N	N	N
1/ 11	do----	.6	Breccia zone with limestone and carbonaceous shale-----	N	N	N

Data for samples shown in figure A-16--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Lead (%)
No.	Type	Length (ft)	Description			
1/ 12	Chip--	1.3	Gray to brown, clay-rich breccia zone------------------	N	N	N
1/ 13	do----	2.2	Compact to friable, banded breccia zone is bleached and slightly iron-oxide stained---------------------------	N	N	N
1/ 14	do----	4.3	Sheared gray to brown shale----------------------------	N	N	N
15	do----	2.1	Dark gray clay gouge and calcite-filled breccia--------	N	N	N
16	do----	2.3	Gouge and punky breccia zone with 0.5-ft-thick, indurated, gray breccia--	N	0.5	0.03
1/ 17	do----	8.2	Shear and gouge zone-----------------------------------	0.110	N	.01

1/ Additional analyses:

	Copper%	Zinc%	Barium%
sample 1	N	0.02	--
10	--	--	N
11	--	--	N
12	--	--	N
13	--	--	N
14	--	--	N
17	N	.01	--

50 ft and the other collapsed at the collar, are located near the portal of the main adit, and two small adits are south of the portal. Goodwin (1957, p. 661) reported a shaft sunk 300 ft on a limestone-diorite contact with drifting on three levels. The dump is estimated to contain 500 to 700 yd^3 (cubic yard) of waste. A ruin of a small cabin is about 250 ft southeast and across the wash from the mine.

SAMPLING: Fifteen chip and two random chip samples were taken on the property. Sample locations are shown on figure A-16, and analytical data are listed in the accompanying table. Only samples from the intensely brecciated limestone and the East Providence fault gouge contained significant metal values. Of five samples from these zones, three contained 0.01 to 0.11 oz/ton gold, and four contained 0.3 to 1.0 oz/ton silver and 0.01 to 0.06 percent lead. The highest gold value is associated with the East Providence fault gouge zone, and the highest silver value came from the brecciated limestone.

CONCLUSIONS: On this property the East Providence fault averages 5.5 ft thick, is exposed for 130 ft along strike, and averages 0.04 oz/ton gold, and 0.4 oz/ton silver for three samples (fig. A-16). The limestone breccia is 30 ft thick and is exposed for 80 ft along strike; one sample contained 1.0 oz/ton silver. The deposit is insufficiently delineated and sampled to define resources. The production history, the similarity of the deposit to the Silver King and Bonanza King mines (plate 1, nos. 144 and 146), and significant gold and silver values in reconnaissance samples indicate that the property merits additional investigation for silver, gold, lead, and copper resources at depth and along the fault zone. Any resources would most likely be associated with hematite-cemented breccia zones in the carbonate rocks.

NAME: Okaw mine

OWNER: Hugh Dankiness, Robert Dansie, George Warren, Gar Watts, and Piute Canyon Mines, Inc.

INDEX MAP NO.: Plate 1, no. 77

LOCATION: SE1/4SE1/4 sec. 11 and SW1/4SW1/4 sec. 12, T. 11 N., R. 13 E., S.B.M. The main workings lie within the study area adjacent to a cherry stem exclusion boundary.

ELEVATION: 3,350 to 3,500 ft

ACCESS: From Kelso, CA, 3.5 mi northeast on the paved Kelso-Cima Road to Hayden Siding, then 2.7 mi east on gravel and jeep roads to the mine site.

HISTORY: San Bernardino County records indicate that several claims were located in this approximate vicinity between 1905 and 1911. The age of the workings is not known. Building foundations near the workings appear to be the remains of a mill. Several actively held claims have been located on this property since 1969. Hugh Dankiness located the Lucky Lady 1-3 1/ in May, 1969, Larry Biggs located the Lucky Lady 4 in November, 1969, Robert Dansie located the WC and BD claims in February, 1977, George Warren located the Lucky Larry in February, 1979, and Gar Watts and Piute Canyon Mines, Inc. located the Ban 1-20 in March, 1981. Due to uncertainty of claim ownership, the name Okaw mine, which appears on the 1982 San Bernardino County Automobile Club of Southern CA Map, will be used in this report.

PRODUCTION: There is no record of historic production. Some stoping, the apparent size of some of the inaccessible workings, and a possible mill site indicate probable minor production.

GEOLOGY OF DEPOSIT: Quartz veins associated with shear and gouge zones crop out in altered quartz monzonite. The veins trend northeast, dip steeply to the south, and are up to 3.7 ft thick. Metallic minerals include galena, chalcopyrite, pyrite, and rare sphalerite. Limonite occurs in vugs and as pseudomorphs after pyrite. Chrysocolla and malachite occur as stains and fracture fillings.

The medium-grained quartz monzonite is intruded by silicic, subvolcanic dikes. Both the quartz monzonite and the dike rocks have undergone sericitic alteration. At one working a silicic dike is offset by a northeast-trending fault, which includes a quartz vein, indicating that the mineralizing episode postdates the dikes.

1/ The underlined claim names were still held in 1982 according to BLM mining claim records.

WORKINGS AND FACILITIES: Workings include five shafts, three adits, and eight pits (fig. A-17). The main working (shaft 1) is steeply inclined and of undetermined depth. Four other shafts range in depth from about 10 ft (shaft 2) to approximately 100 ft (shaft 4). Three adits are 105, 30, and 24 ft long (fig. A-18).

SAMPLING: The locations of 16 chip, 3 select and 2 grab samples taken on the property are shown on figures A-17 and A-18, and the analytical results are listed in the accompanying table. Most of the samples contained gold and silver. Seventeen samples contained from a trace to 0.29 oz/ton gold and 0.029 to 6.1 oz/ton silver; 4 contained 0.1 oz/ton gold or more and 7 contained 1.0 oz/ton silver or more. All samples contained lead; eight contained 1.2 to 7.8 percent. Copper values ranged from 0.00091 to 0.83 percent, and molybdenum values ranged from 0.0018 to 0.027 percent in 15 samples analyzed.

CONCLUSIONS: Major workings (shafts) that may expose resources could not be entered. Samples (nos. 5-10) taken from the 105-ft adit contained only minor amounts of gold and silver and less than 1 percent lead. Although no resources are identified, the number of mineralized veins, and samples with sporadically high gold, silver, lead, and copper content suggest that further exploration is warranted.

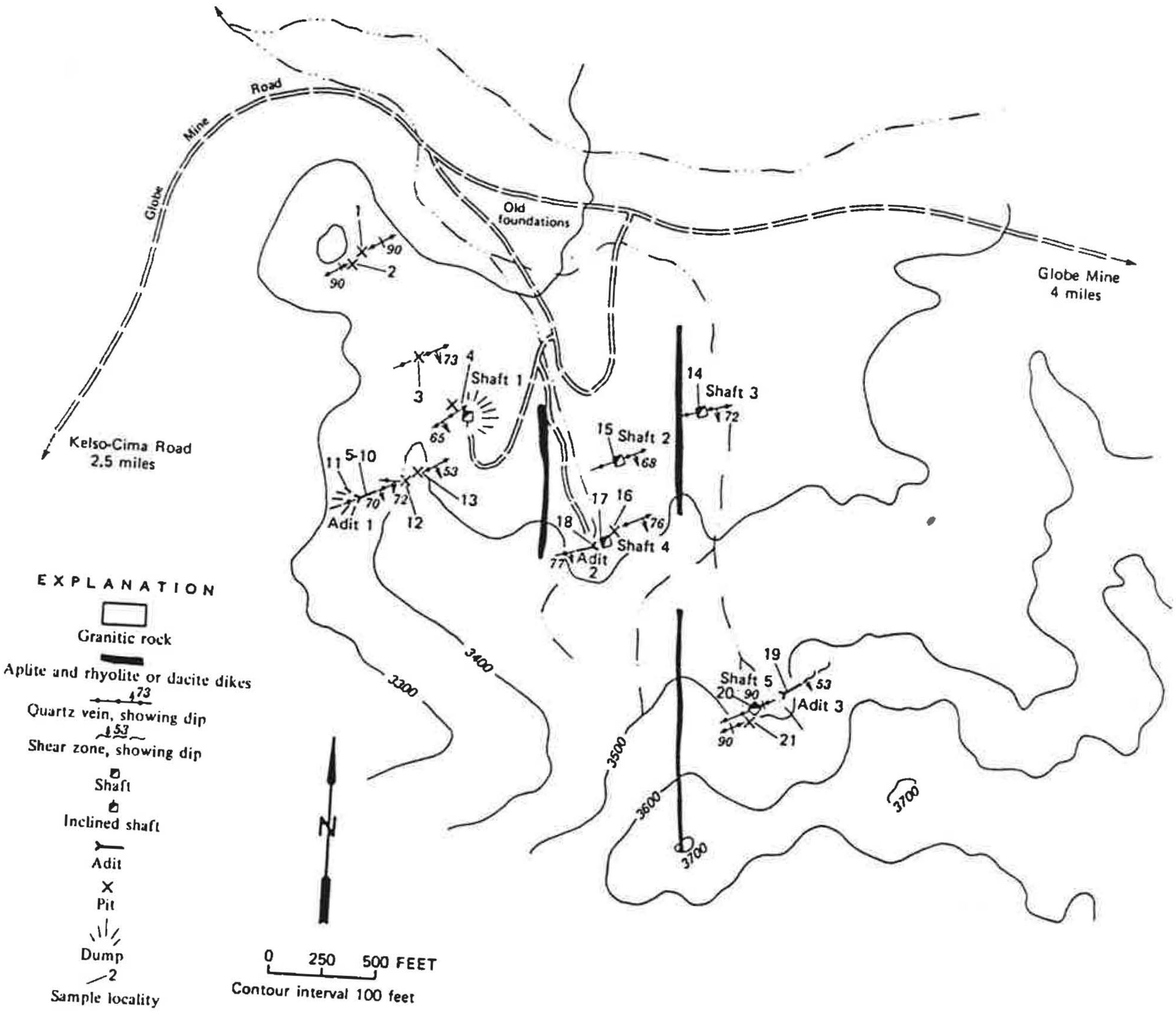

FIGURE A-17—Surface map, Okaw mine

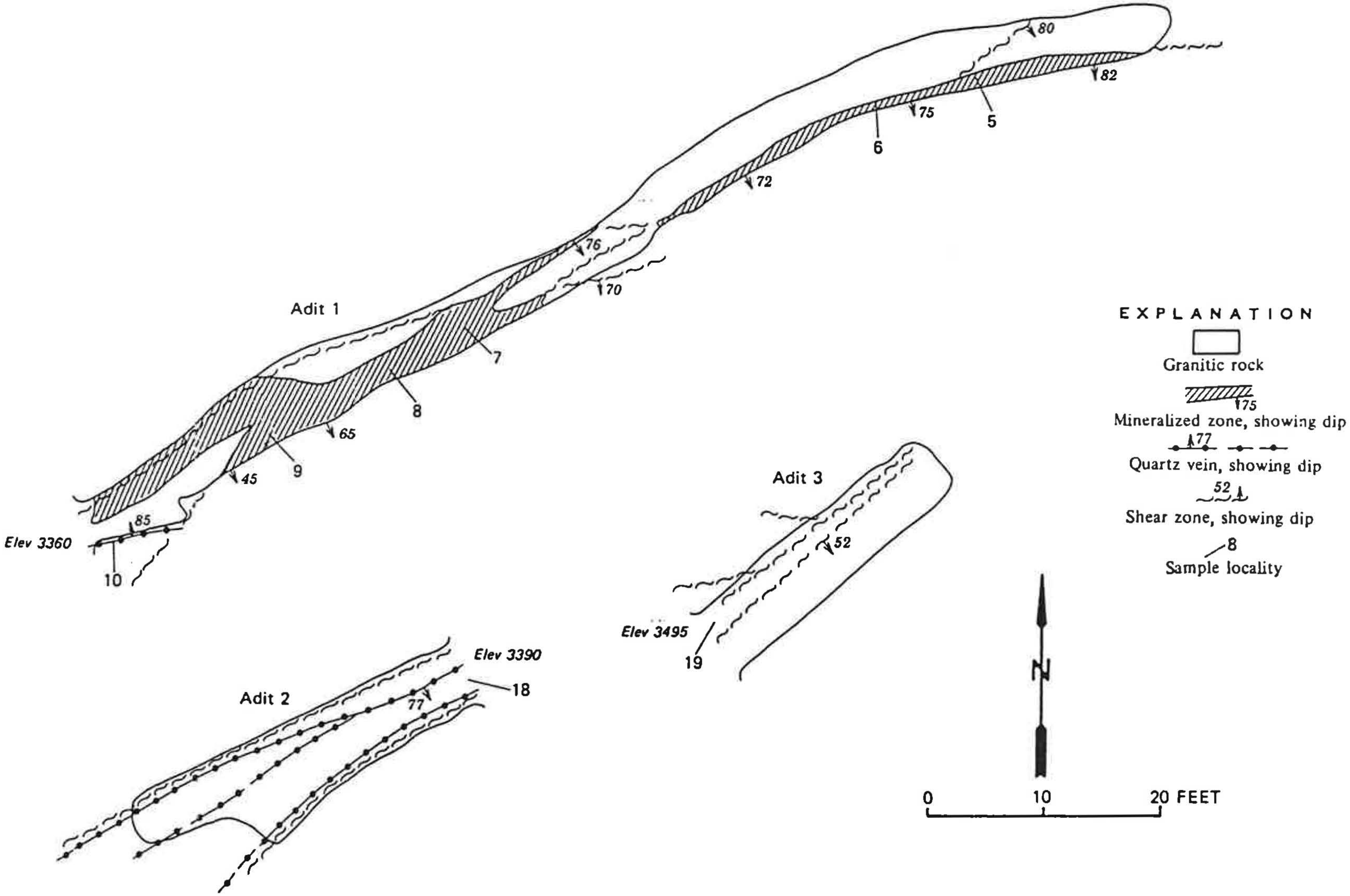

FIGURE A-18—Underground maps, adits 1–3, Okaw mine

Data for samples shown in figures A-17 and A-18

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
1	Chip--	1.0	Across quartz vein, 1 in. to 1 ft thick, containing limonite after pyrite and iron-oxide stains-------	N	1.2	0.0058	0.141	0.0025	--
2	do----	1.0	White quartz vein with limonite after pyrite----------------------	0.02	.4	.0029	.065	.0028	--
1/ 3	do----	2.0	Across 1- to 2-ft-thick white quartz vein. Contains irregular stringers of galena, chalcopyrite, and pyrite. Pyrite and chalcopyrite partially altered to limonite with some secondary copper mineral stains----	.12	3.8	.018	1.3	N	0.0018
1/ 4	Grab--	NA	Quartz vein material from dump and outcrop at collar of shaft. Contains galena, pyrite, limonite, and secondary copper minerals------	.02	1.0	.042	2.4	N	.0039
5	Chip--	1.5	Across quartz vein and country rock; some disseminated galena and iron oxide----------------------------	N	N	.019	.9	N	.0047
6	do----	.6	Quartz vein with sericitically altered country rock. Vein contains pyrite, galena, and limonite after pyrite---------------------------	Tr	.1	.013	.87	N	.0210

Data for samples shown in figures A-17 and A-18--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
7	Chip--	2.5	Across quartz vein with sulfides and quartz veinlets in quartz monzonite. Veins contain galena and possible chalcopyrite----------------------	N	0.1	0.019	0.73	N	0.015
8	do----	.7	Quartz vein with abundant galena, chalcopyrite, and pyrite-----------	N	N	.0084	.18	N	.0088
9	do----	3.7	Across quartz vein with galena, pyrite, and limonite after pyrite--	Tr	N	.0084	.40	N	.0120
10	do----	1.7	Across quartz vein and thin gouge zone. Vein has minor sulfides and limonite after pyrite----------	Tr	N	.0044	.14	N	.0049
1/ 11	Select	NA	Iron-oxide stained quartz with relict pyrite, some primary sulfides, and secondary copper minerals---------------------------	0.018	.5	.125	1.45	0.0017	--
12	Chip--	2.5	White quartz with visible galena----	.01	.1	.0009	.070	N	.0057
13	do----	1.2	Outcrop of quartz vein; contains galena and fresh to partially oxidized pyrite--------------------	.01	.2	.010	.43	N	.0110

Data for samples shown in figures A-17 and A-18--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
1/ 14	Chip--	1.3	Across white quartz vein with galena stringers, replaced pyrite cubes, and earthy-hematite-filled cavities--------------------------	0.11	3.3	0.046	4.6	N	0.0071
1/ 15	Grab--	NA	Quartz vein and silicified breccia; considerable hematite with some galena, replaced pyrite, and secondary copper minerals----------	.22	6.1	.3	7.8	N	.0260
1/ 16	Chip--	1.7	Across quartz vein and veinlets in foliated granite; some limonite stains, hematite, and secondary copper minerals-------------------	.0013	.029	.0070	.086	N	.0051
1/ 17	Select	NA	Quartz vein material with some galena and pyrite, minor chalcopyrite and secondary copper minerals; from stockpiles------------------------	.02	.9	.084	1.2	N	.027
1/ 18	Chip--	3.5	Across shear zone containing two small veins of white quartz; shear zone contains considerable red, earthy hematite-------------------	.007	.195	.0052	.78	N	.0041
19	do----	2.0	Across 0.5-ft-thick shear zone; gouge contains some quartz fragments-----	Tr	.1	.0029	.0650	0.0073	--

Data for samples shown in figures A-17 and A-18--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
20	Select	NA	Quartz stockpiled near shaft. Veinlets in granitic country rock contain galena, chalcopyrite, chrysocolla, sphalerite, and sericite--------------------------	0.09	1.7	0.097	1.66	0.193	--
21	Chip--	1.0	Quartz veinlets in granite contains galena, chalcopyrite, chrysocolla, and sphalerite--------------------	.29	3.4	.83	4.3	.50	--

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1/ Additional analyses:

sample	Tungsten %	Tin %	Bismuth %
3	0.0006	N	N
4	.0006	N	N
11	N	--	--
14	.0005	N	N
15	--	--	0.0170
16	--	--	N
17	.0005	--	N
18	.0006	N	N

NAME: Jo Je mine

OWNER: Gar Watts and others (Can claims); John Beres (Lucky Lady claims)

INDEX MAP NO.: Plate 1, no. 96

LOCATION: NW1/4 sec. 23, T. 11 N., R. 13 E., S.B.M. The property is located within a cherry stem exclusion from the study area.

ELEVATION: 3,040 to 3,200 ft

ACCESS: From Kelso, CA, drive 3.5 mi northeast on the paved Kelso-Cima Road to Hayden Siding, then 3 mi southeast on a four-wheel-drive road to the mine site.

HISTORY: Wright and others (1953, p. 44 tables) report that the Jo Je (Midway) mine was worked intermittently since the early 1900's, mostly in the mid-1920's and in the early 1940's. USBM statistical files record the owners in 1937-38 as the Jo Je Mining Co. and in 1940-42 as H. E. Doran. E. M. Manny owned the mine in 1953, although it had been idle since 1944 (Wright and others, 1953). Three overlapping claim groups were located on the property in 1981: (1) the Can claims in March and April, (2) the Lucky Lady claims in June, and (3) the Raindrop No. 1 in August (not recorded with the BLM).

PRODUCTION: Table A-2 shows production from the Jo Je mine recorded by USBM statistical files. Ore was treated in a small cyanide mill on the property (fig. A-19). Considering the relative size of the underground developments in the mine, actual production might be several times that which is reported.

GEOLOGY OF DEPOSIT: The deposit consists of two, subparallel quartz veins 500 ft apart which trend west-northwest and dip moderately to steeply south in granitic rock (fig. A-19). The veins range from 1 to 3 ft thick and crop out for 700 ft (south vein) and 900 ft (north vein). The massive to brecciated quartz is milky white to translucent gray, moderately vuggy, and slightly iron-oxide stained. Brecciated quartz is cemented with a matrix of earthy hematite. Limonite pseudomorphs after pyrite and rare galena are in the quartz. The veins are in fault gouge zones several feet thick. Branching and radical pinch-and-swell structure of the veins is implied by the lack of continuous outcrop between workings and the height of underground room and pillar areas. Two northwest-trending, northeast-dipping faults offset the vein in shaft 3 (fig. A-20). The maximum observed vertical throw (normal) is 2 to 3 ft.

Country rock consists of 30 to 35 percent potassium feldspar, 30 to 35 percent quartz, and 25 to 30 percent plagioclase slightly altered to sericite. A green andesite dike lies subparallel with and in some places adjacent to the south quartz vein. The north and south veins are apparently in the footwall and the andesite dike in the hanging wall of a wide zone of shearing or faulting.

TABLE A-2.--Production from the Joe Je mine recorded in USBM statistical files

(NA, not applicable)

Year	Crude ore (tons)	Gold		Silver	
		Recovered (oz)	Average grade (oz/ton)	Recovered (oz)	Average grade (oz/ton)
1937	30	9.00	0.30	34	1.1
1938	25	9.00	.36	34	1.4
1940	50	27.00	.54	131	2.6
1941	45	17.00	.38	124	2.8
1942	35	10.00	.29	69	2.0
Total	185	72.00	NA	392	NA
Average	NA	NA	.39	NA	2.1

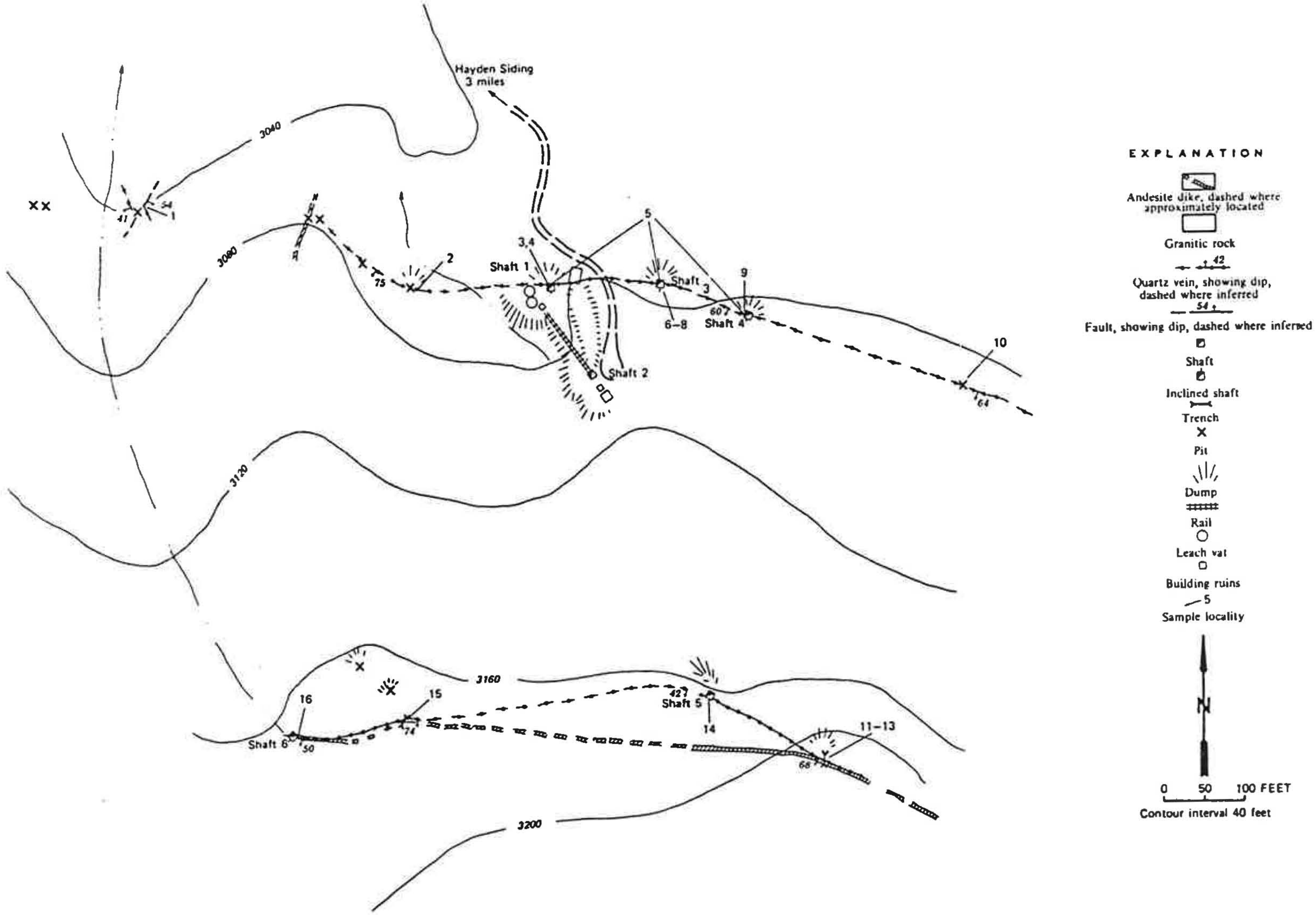


FIGURE A-19—Surface map, Jo Je mine.

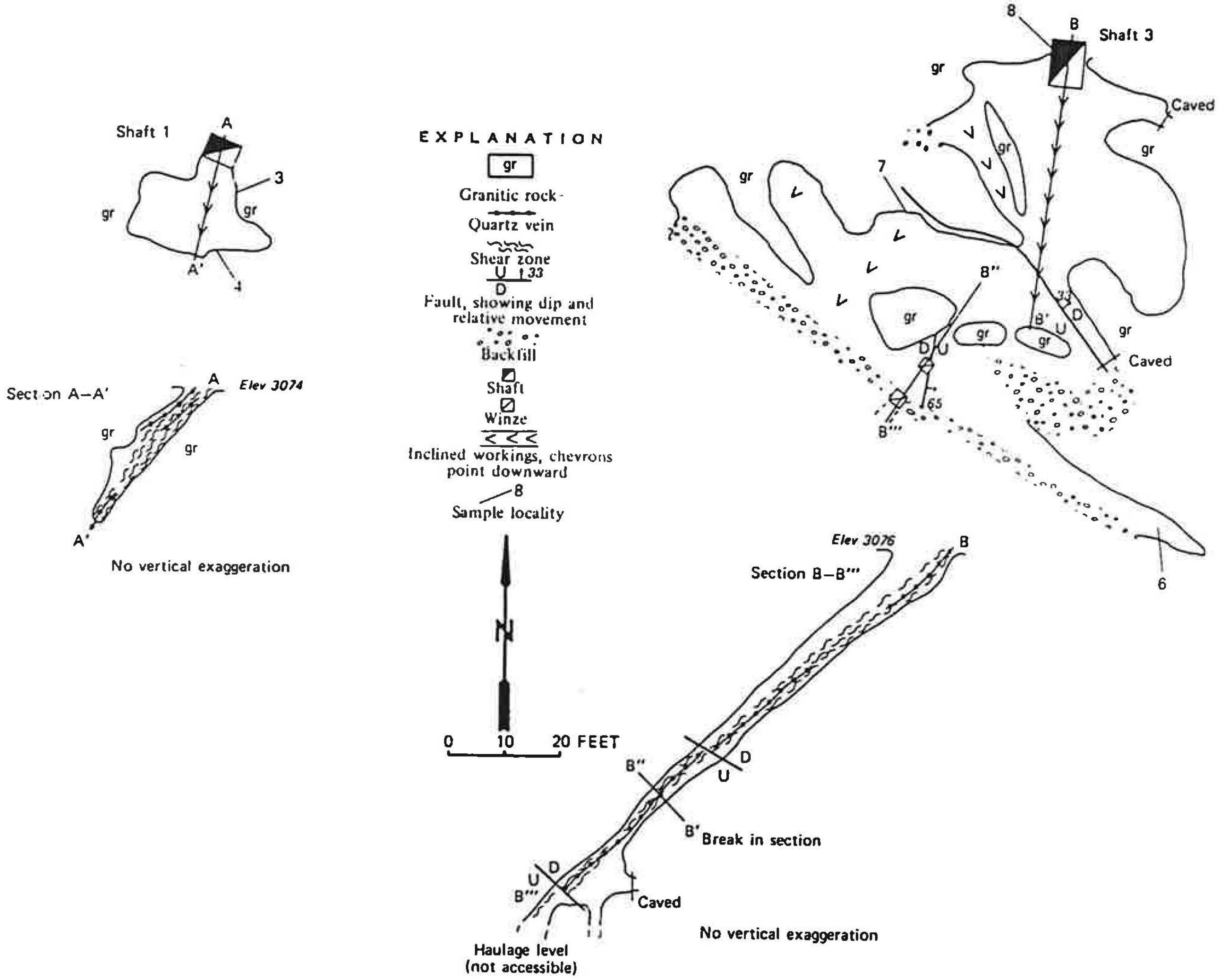


FIGURE A-20—Underground maps and sections, shafts 1 and 3, Jo Je mine

Data for samples shown in figures A-19 and A-20

[N, none detected; --, not analyzed; NA, not applicable]

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
1	Chip--	2.0	White, iron-oxide stained, massive to brecciated quartz in gouge; vein offset by fault----------------------------------	0.020	N	0.03	--	--
2	do----	1.0	Quartz breccia and gouge-------------------	N	N	.01	--	--
3	do----	2.9	Moderately vuggy, iron-oxide stained, fractured and hematite healed quartz and quartz breccia in a clay matrix-----------	N	1.6	.02	--	--
4	do----	1.3	Fractured, iron-oxide cemented quartz in shear zone---------------------------------	N	.4	.01	--	--
5	Select	NA	Composite sample from collars of shafts 2, 4, and 5; white to gray, brecciated quartz with gouge matrix-----------------	.163	2.1	.0091	0.12	0.0013
6	Chip--	2.0	Iron-oxide stained, sulfide-bearing quartz vein---------------------------------------	N	.8	.01	--	--
7	do----	2.5	Across fractured, iron-oxide stained quartz vein separated by gray to green gouge------	.134	.4	.03	--	--
8	do----	1.2	Quartz vein, 1.0 ft thick, and gouge zone---	N	.3	.01	--	--
9	do----	2.2	Punky gouge and red to yellow stained, fractured to brecciated quartz-------------	.040	N	N	.03	N

Data for samples shown in figures A-19 and A-20--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
10	Chip	0.7	White quartz vein	N	N	N	--	--
11	do	1.5	Intensely fractured shear and gouge zone with abundant quartz	N	N	0.01	0.04	0.01
12	do	5.0	Continuation of sample 11; iron-oxide altered and stained granitic rock and andesite dike	N	N	N	.04	.01
13	do	1.8	White to gray quartz vein, 1.0 ft thick, with earthy hematite, limonite after pyrite, and galena	0.106	N	.01	.53	.01
14	do	.9	Fractured, limonite healed quartz vein in bleached granitic rock	.018	N	.02	.12	.01
15	do	2.0	Quartz vein interfingered with andesite dike above and below gouge zone	.012	N	.01	.06	.01
16	do	2.3	Quartz veins 3 to 5 in. thick in gouge zone with silicified quartz monzonite; quartz contains minor pyrite and chalcopyrite	.032	N	.06	.07	N

WORKINGS AND FACILITIES: Workings consist of two vertical shafts, four inclined shafts, two trenches, and nine pits (figs. A-19 and A-20). The shafts range in depth from 15 to 90 ft. Shaft 2 (vertical, 90 ft deep) was evidently a production shaft. It is connected to shaft 3 (inclined, room and pillar) which is accessible only to a depth of 70 ft (fig. A-20). Wright and others (1953, p. 44 tables) reported a 140 ft deep inclined shaft with 300 ft of drifts on two levels (probably shaft 3).

Other developments include a collapsed headframe on shaft 2, haulage rail, an ore bin and grizzly, and two leach vats. Most, if not all, production came from the north vein.

SAMPLING: The locations of 15 chip and 1 select sample taken on the property are shown on figures A-19 and A-20, and the sample descriptions and analytical results are listed in the accompanying table. Eight samples contained gold, and six contained silver. Gold ranged from 0.020 to 0.163 oz/ton and averaged 0.089 oz/ton in 4 samples from the north vein and ranged from 0.012 to 0.106 oz/ton and averaged 0.043 oz/ton in 4 samples from the south vein. Silver ranged from 0.3 to 2.1 oz/ton and averaged 0.9 oz/ton in 6 samples from the north vein; no silver was detected in samples from the south vein. Copper, lead, and zinc values do not exceed 1 percent. Although the select sample contained the highest values for both gold and silver, it may be noteworthy that gold and silver values do not generally correlate well with each other.

CONCLUSIONS: Resources could not be estimated because of the limited data available, the sporadic gold and silver values, and the pinch and swell structure of the deposit. The main pocket (swell) of the deposit has apparently been mined out to shallow depths (shaft 3, fig. A-20); however, further sampling and drilling may expose resources in the lower workings. Based on the production history and the gold and silver values, this deposit may have additional moderate- to high-grade, vein-type gold and silver resources at depth.

NAME: Green Scorpion prospect

INDEX MAP NO.: Plate 1, no. 99

LOCATION: NW1/4SW1/4 sec. 19, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 3,850 to 3,900 ft

ACCESS: From Kelso, CA, 3.5 mi northeast on the paved Kelso-Cima Road to Hayden Siding, then 6.5 mi southeast on gravel road and four-wheel-drive road, then 1/8 mi north cross country.

HISTORY: The Green Scorpion claim group (at least 14 claims) was located in 1956 by the Frione Mining Corporation, James G. Cooney, Vice President. The property was not claimed in 1984. The workings probably predate the 1950's.

GEOLOGY OF DEPOSIT: Workings are on a northeast-trending, northwest-dipping fault or shear zone (fig. A-21) in a metamorphosed igneous roof pendant in a granitic intrusive rock. The zone is composed of quartz breccia, a massive to fractured quartz vein, and clayey gouge. It is exposed discontinuously for about 185 ft along strike and averages 2.3 ft thick. The vein contains relict sulfides, secondary copper minerals, and iron- and manganese-oxide staining. Fine- to medium-grained, felsic to intermediate composition, porphyritic dikes, which have undergone extensive silicification, carbonatization, and sericitization are exposed in the adit and the open cut. The dikes trend northwest, are vertical, and are probably cut by the mineralized fault zone.

WORKINGS AND FACILITIES: The property has one adit, (55 ft long), a pit, and the remains of a cabin (fig. A-21).

SAMPLING: One select and four chip samples were taken. Sample localities are shown on figure A-21, and sample descriptions and analytical results are listed in the accompanying table. All contained gold which ranged from 0.0005 to 0.16 oz/ton and averaged 0.1 oz/ton. Four samples contained silver, ranging from 0.04 to 0.3 oz/ton. Copper values ranged from 0.012 to 0.17 percent. One sample contained 0.0039 percent zinc, and two samples analyzed for molybdenum contained 0.0062 and 0.0047 percent.

RESOURCE ESTIMATE: The deposit contains about 3,300 tons with a weighted average grade of 0.086 oz/ton gold. The estimate is based on an exposed strike length of 185 ft, a projection to depth of one half the strike length, and an average thickness of 2.3 ft. A tonnage factor of 12 ft^3/ton is used. Due to lack of exposure, no projection is made along strike.

CONCLUSIONS: The Green Scorpion deposit has an estimated unit value ($400/oz gold) of $34/ton but is too small to be mined as a single body. The consistent gold values indicate that the property merits additional investigation.

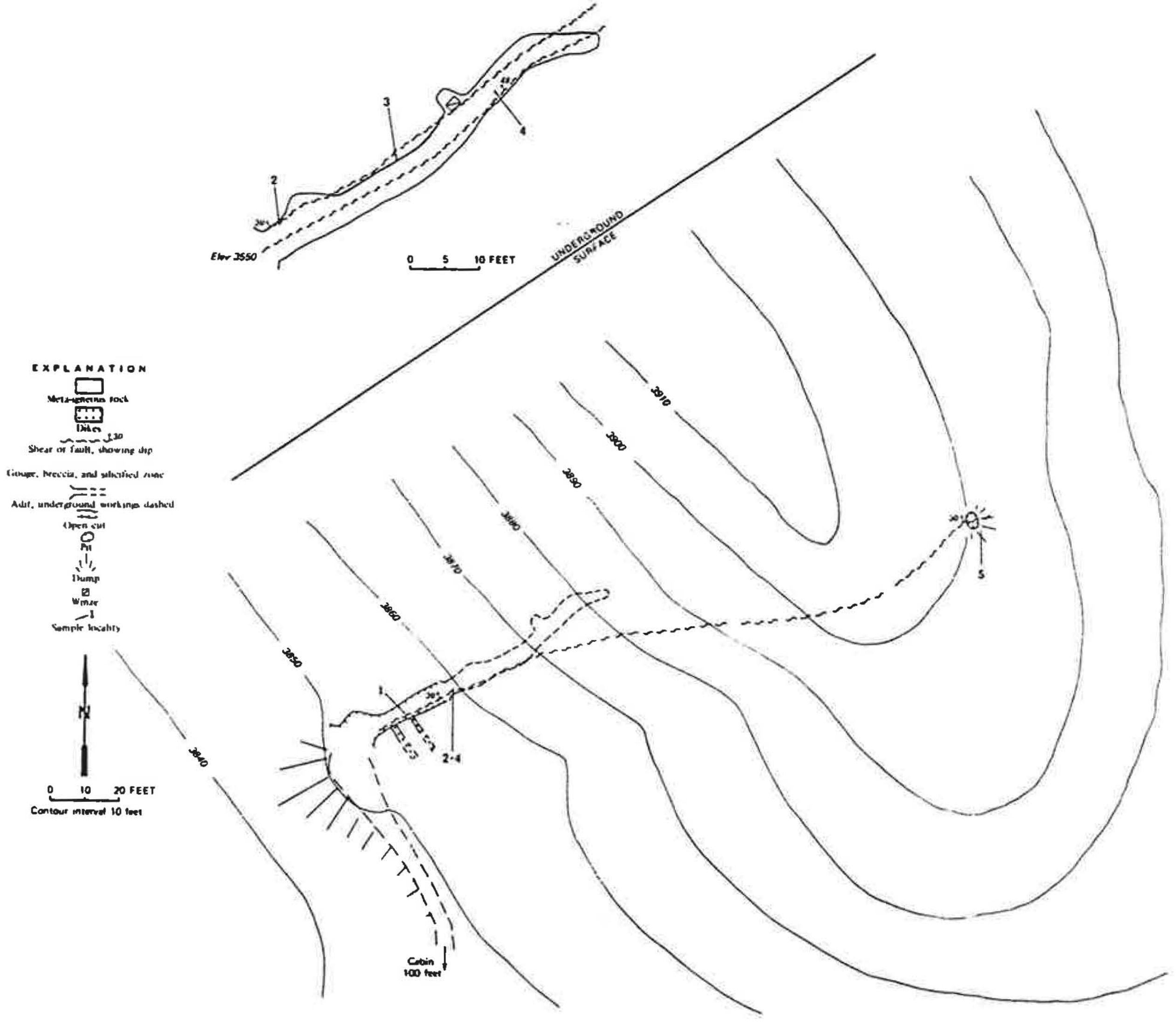


FIGURE A-21—Surface and underground maps, Green Scorpion prospect

Data for samples shown in figure A-21

[N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
*1	Chip--	2.0	Across medium-grained intrusive rock with propylitic alteration and some quartz breccia in footwall	0.0005	N	0.012	--	--	--
*2	do----	1.8	Across zone parallel to a fault that strikes N. 65° E. and dips 30° NW. and contains clay gouge and opaque, gray quartz	.15	0.1	.028	N	0.0039	0.0062
*3	do----	2.9	Clay like gouge, breccia and silicified zone; gray to white banded and orange to maroon iron-oxide stains; possible replaced sulfides	.067	.04	.023	--	--	--
*4	do----	2.5	Across gouge zone with quartz fragments, soft gouge, and quartz breccia; some secondary copper minerals along fractures with iron- and manganese-oxide stains	.13	.3	.17	N	N	N
5	Select	NA	From stockpile at pit; vein composed of quartz with some sericite and manganese-oxide encrustations	.16	.1	.03	N	N	.0047

*Samples used to calculate tonnage and grade.

NAME: Fan 1-5 prospect

OWNER: Gar Watts and Piute Canyon Mines, Inc.

INDEX MAP NO.: Plate 1, no. 102

LOCATION: E1/2 sec. 19 and NW1/4 sec. 20, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,000 to 4,300 ft

ACCESS: From Kelso, CA, 3.5 mi northeast on the paved Kelso-Cima Road, then approximately 7 mi southeast on gravel and four-wheel-drive roads.

HISTORY: The Jimura claim was located in 1955 and amended and renamed the Ora in 1956. The Fan claim group was located at the same site in 1981 and was still held in 1982. The workings are probably older than any of these claims.

PRODUCTION: There is no record of production; however, stoping in one of the workings may indicate a small amount of production.

GEOLOGY OF DEPOSIT: The country rock in this area ranges from Precambrian (Hewett, 1956) granite gneiss to granitic intrusive rock of probable Mesozoic age. The area was intensely faulted and intruded by dikes of rhyolitic to dacitic composition. The workings are on fault or shear zones containing quartz veins, breccia, gouge, and silicified zones. Minor amounts of secondary copper minerals and sulfides occur locally within these zones. The country rock adjacent to the faults has undergone some bleaching and chloritic alteration.

WORKINGS AND FACILITIES: Workings include 5 adits, ranging in length from 37 to 125 ft, and 10 pits (figs. A-22 and A-23). Adit 2 has a flooded winze, and adit 4 has a 25-ft raise to the surface (shown on fig. A-22 as a shaft). The remains of a shack and a small, concrete reservoir are also on the property.

SAMPLING: Twenty-six samples were taken on the property. Sample localities are shown on figures A-22 and A-23, and sample descriptions and analytical results are listed in the accompanying table. Of all samples, 16 contained gold, ranging from 0.0006 to 1.059 oz/ton, and 19 contained silver, ranging from 0.003 to 33.6 oz/ton. Three of the samples contained at least 0.1 oz/ton gold per ton or more, and four of the silver values were greater than 1.0 oz/ton. Other assay values ranged from 0.0002 to 0.0305 percent copper, 0.017 to 2.6 percent lead, 0.0018 to 0.083 percent zinc, 0.0006 to 0.0022 percent molybdenum.

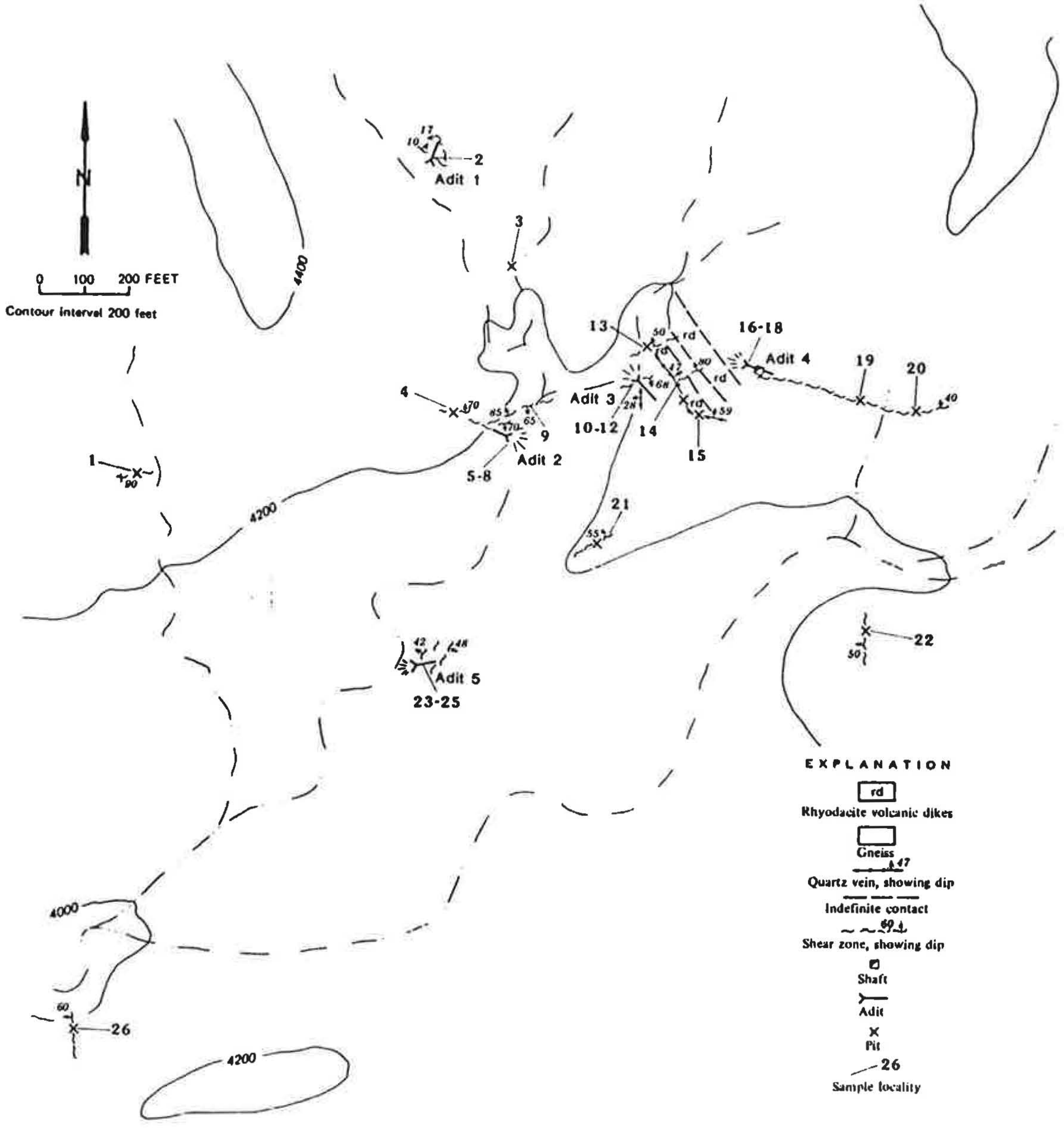


FIGURE A-22— Surface map, Fan 1—5 prospect

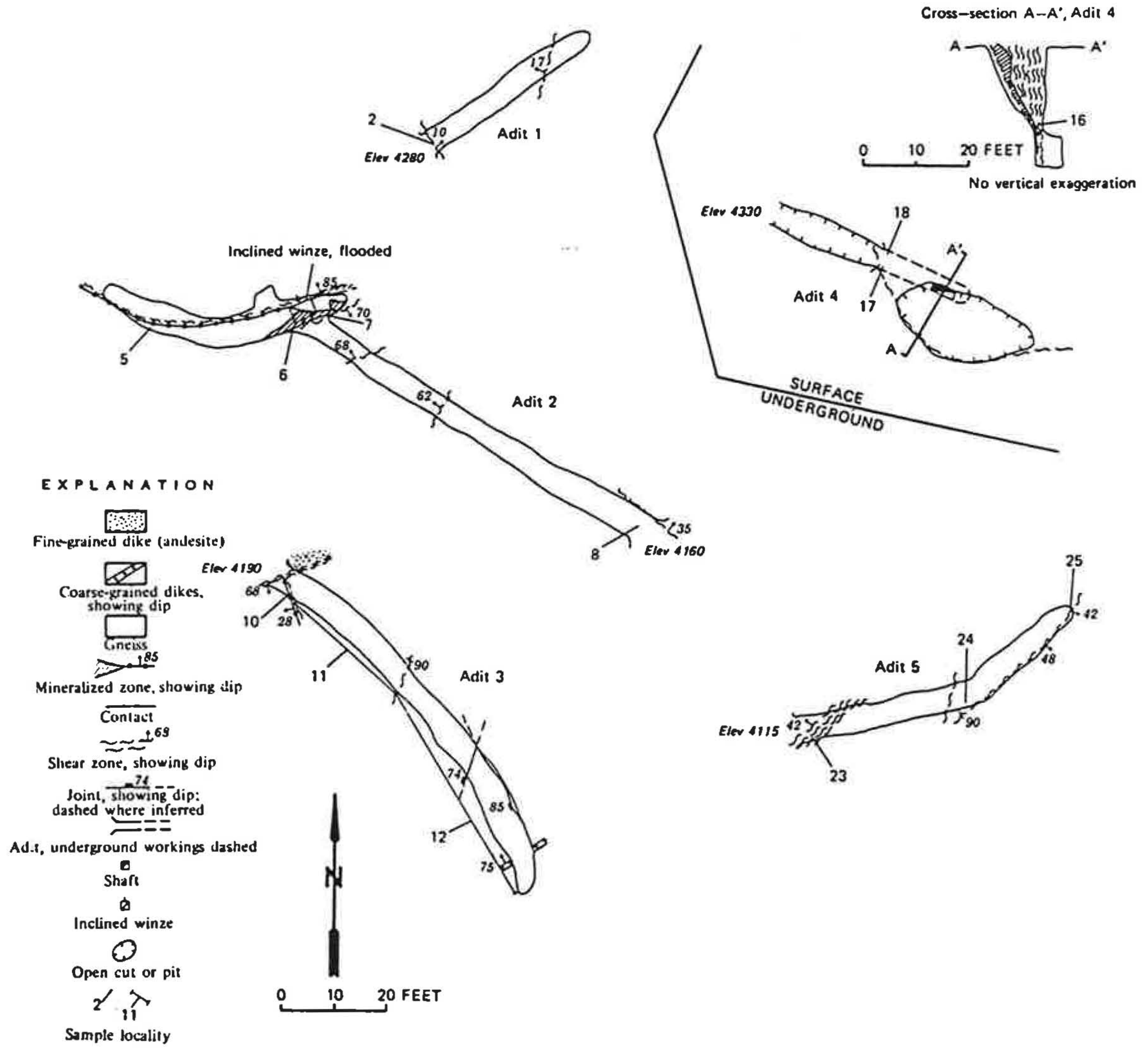


FIGURE A-23—Underground maps, adits 1—3 and 5, and surface map and section, adit 4, Fan 1—5 prospect

Data for samples shown in figures A-22 and A-23

[N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
1	Chip	1.5	Across vertical quartz vein in locally bleached and altered country rock	0.092	3.2	--	--	--	--
2	do	.7	Across a shallow dipping quartz breccia and gouge zone	N	N	--	--	--	--
3	Random chip	NA	Some coarse-grained zones and quartz lenses in gneiss	.02	1.1	0.0047	--	--	--
4	Chip	.2	Across vein of white quartz; vein is iron-oxide stained and is in locally altered gneiss country rock	.176	7.2	--	--	--	--
5	do	.7	Across quartz breccia and shear zone	N	N	.0002	--	--	--
6	do	2.3	Across quartz breccia containing azurite, malachite, and minor sulfides	.026	33.6	.0305	--	--	--
7	do	2.0	Visible chalcopyrite in chloritic quartz breccia	N	.6	.0170	--	--	--
8	do	1.0	Across shear in gneiss; dark brown with abundant biotite	N	N	--	--	--	--

Data for samples shown in figures A-22 and A-23--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
No.	Type	Length (ft)	Description						
9	Chip--	5.5	Across fractured, silicified zone in fine grained to porphyritic andesitic dike--------------------	N	0.012	N	2.6	N	--
10	Random chip--	NA	Through 48 ft of lenticular to banded gneiss; minor sulfides along some fractures-------------------------	N	N	N	N	N	N
11	do----	NA	Through 27 ft of moderately to slightly fractured, jointed, granite gneiss; some iron-oxide stains and chlorite---------------	0.002	N	N	N	N	0.0006
12	Chip--	.8	Across iron-oxide stained gouge zone; contains gray quartz, gneiss, leached feldspars, and pockets of powdery specularite; zone is intensely weathered---------------	.004	.052	N	N	N	.0012
13	do----	2.5	Across approximately 3-in.-thick shear zone in granite or granite gneiss; some specularite on fracture-------------------------	.0003	.012	N	.0170	0.0050	N
14	do----	1.1	Across most intensely silicified portion of quartz vein swell along altered zone----------------------	1.059	.755	0.0140	.0290	.0210	N

Data for samples shown in figures A-22 and A-23--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
15	Chip--	2.0	Across very thin quartz vein in chloritically altered, porphyritic, rhyodacite dike-------------------	0.021	0.782	0.0032	0.0260	0.0160	N
16	do----	1.9	Across midpoint of quartz-chlorite gouge and breccia; pinching rapidly with depth------------------------	.687	.779	.0093	.0260	N	N
17	do----	.8	Silicified gouge and breccia zone; contains fragments of quartz and gneiss-----------------------------	.007	.067	.0036	.0550	.0150	N
18	do----	2.5	Across hanging wall adjacent to breccia; medium- to coarse-grained granite or granitic gneiss---------	N	.003	N	.0270	.0021	N
19	do----	1.8	Zone of 1- to 2-ft-thick quartz veinlets in chloritically altered granite or granodiorite; relict sulfides (?)----------------------	.038	.936	.0190	.2900	.0830	0.0014
20	do----	1.2	Fault zone from 1 to 2 ft thick with 2- to 5-in.-thick quartz vein; some iron-oxide in quartz--------------	.005	.146	.0030	N	.0031	.0022
21	do----	1.2	Prominent structure in gneiss; 0.9-ft-thick, iron-oxide stained gouge with altered gneissic breccia-----------	.0012	.015	N	N	N	.0014

Data for samples shown in figures A-22 and A-23--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Molybdenum (%)
22	Chip--	.8	Across micaceous, schistose fault gouge in metaigneous country rock	--	--	--	--	--	--
23	do----	4.0	Across bleached gneiss with thick epsomite coating; about 6 in. of silicified stringers at base and punky chloritic pod or stringer at the top of the zone------------	0.003	0.222	0.0072	N	0.0240	0.0010
24	do----	.3	Chloritically altered gneiss and gouge with iron oxide; coated with epsomite-------------------------	N	.009	N	N	.0049	.0013
25	do----	4.0	Punky gneiss and gouge stringers with one zone of silicified gneiss, about 4 in. thick, along hanging wall----	.0006	.023	N	N	.0018	.0008
26	do----	1.0	Across poorly exposed iron-oxide stained shear zone in granite gneiss; total thickness unknown------------	N	N	N	1.6	N	--

CONCLUSIONS: Several samples from this area contained high assay values for gold and silver; however, the structures sampled either could not be traced over a significant distance or, where sampled elsewhere, contained only minor amounts of gold and silver. Further sampling and exploration are warranted to determine whether or not resources are present.

NAME: Pink Jack prospect

INDEX MAP NO.: Plate 1, no. 104

LOCATION: NE1/4 sec. 26, T. 11 N., R. 13 E., S.B.M.

ELEVATION: 3,500 to 3,600 ft

ACCESS: From Kelso, CA, 3.5 mi northeast on the paved Kelso-Cima Road, then 5 mi east on gravel and four-wheel-drive roads.

HISTORY: The Pink Jack claim was located in 1974, but the workings are older. The claim was not held in 1984.

GEOLOGY OF DEPOSIT: The country rock is granite gneiss. The gneiss is intensely faulted and intruded by andesite and pegmatite (quartz plus potassium feldspar) dikes. The country rock adjacent to the dikes is commonly sheared. Unsheared gneiss near the dikes is altered. Minor amounts of chrysocolla and malachite, along with limonite and earthy hematite, occur in the pegmatites. Sulfide minerals, primarily pyrite, are rarely observed, but relict sulfides and boxwork structures are common.

WORKINGS AND FACILITIES: The main adit is 115 ft long with three drifts totaling 105 ft (figs. A-24 and A-25). At the end of one drift, a raise extends about 25 ft to the surface, and a winze extends approximately 25 ft down to an inaccessible lower level. A 5-ft-long adit and four pits and open cuts comprise the remainder of the workings.

SAMPLING: Eleven chip and four random chip samples were taken on the property. Sample locations are shown on figures A-24 and A-25, and sample descriptions and assay values are listed in the accompanying table. Thirteen of the samples contained detectable gold. Nine of these had values greater than 0.03 oz/ton gold and averaged 0.17 oz/ton gold. The higher gold values are associated with pegmatites.

Samples analyzed also contained minor amounts of silver, copper, lead, and zinc. The values for these metals ranged from 0.0009 to 0.093 oz/ton silver, 0.0006 to 0.266 percent copper, 0.0031 to 0.089 percent lead, and 0.0023 to 0.021 percent zinc.

CONCLUSIONS: Significant concentrations of gold occur in pegmatite dikes, and lower concentrations are associated with silicified shear zones. Although these structures do not appear to be continuous, further exploration is warranted to determine the extent of the mineralization. The proximity of this area to other gold-bearing prospects (plate 1, nos. 105, 107, and 108) indicates widespread gold mineralization and possible gold resources at depth.

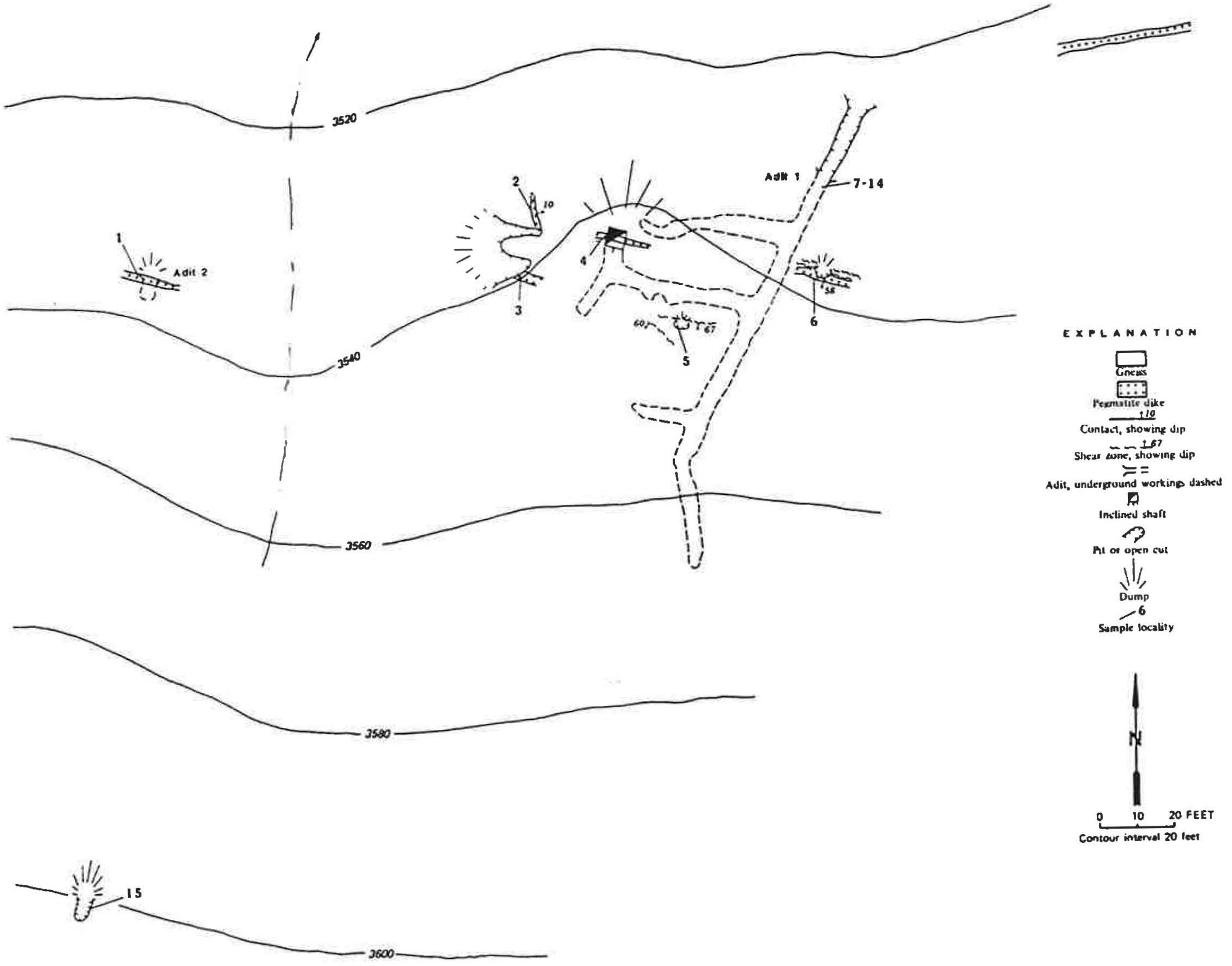


FIGURE A-24—Surface map, Pink Jack prospect

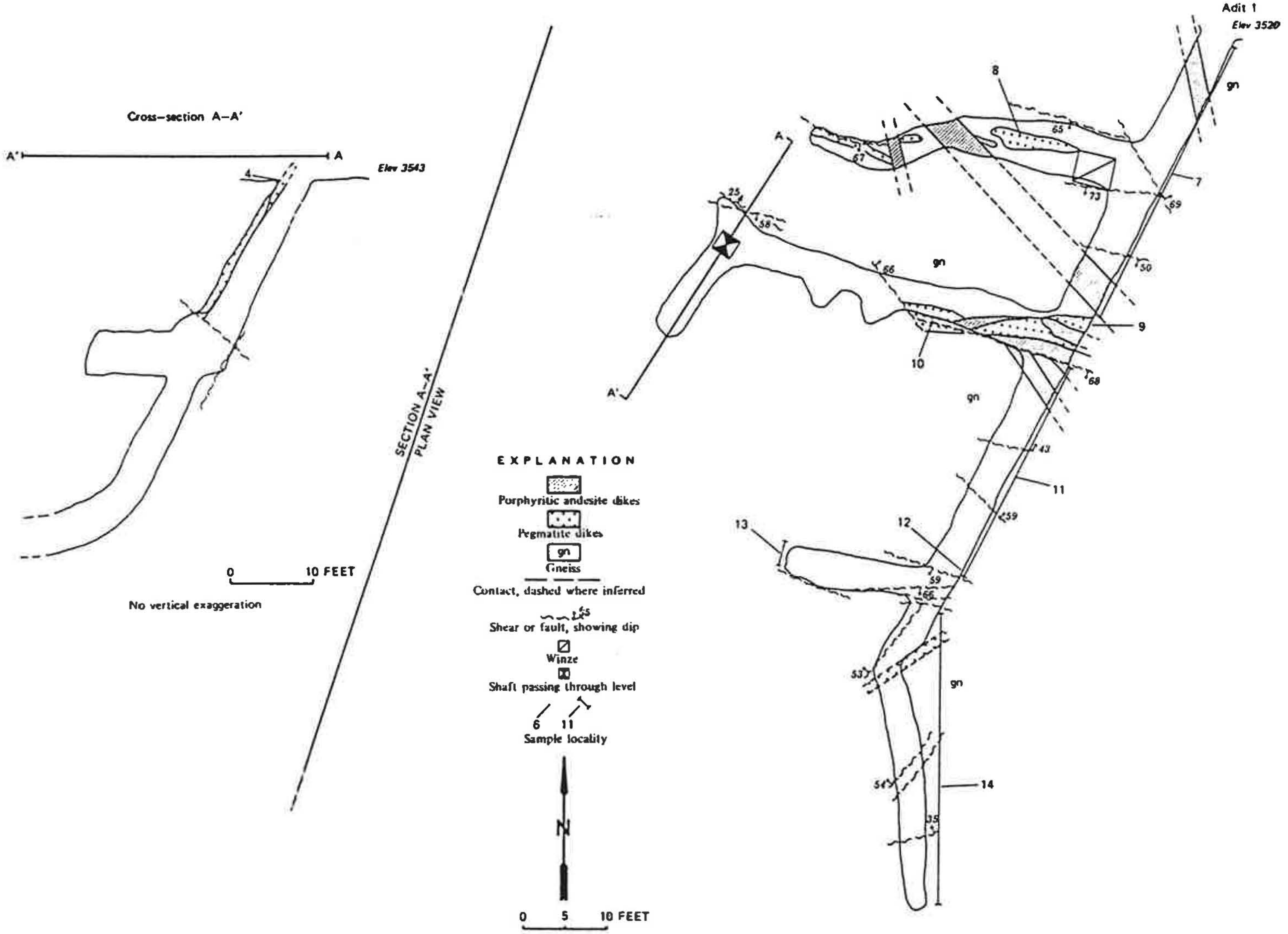


FIGURE A-25– Underground map and section, adit 1, Pink Jack prospect

Data for samples shown in figures A-24 and A-25

[N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold	Silver	Copper	Lead	Zinc
No.	Type	Length (ft)	Description	(oz/ton)	(oz/ton)	(%)	(%)	(%)
1	Chip--	2.0	Across iron-oxide and secondary-copper-mineral stained pegmatite dike; vuggy with hematite in relict sulfides----------------	0.56	0.087	0.067	0.0081	0.0023
2	do----	1.5	Across coarse-grained vein with some iron- and manganese-oxide stains; gneissic country rock on both sides is altered------	.154	.05	.168	.0052	.0090
3	do----	5.5	Across highly silicified zone of two quartz pegmatite dikes along with a 2-ft wedge of altered gneiss. Intense iron-oxide stains and considerable boxwork------------	.103	.058	.022	.0045	.0030
4	do----	1.0	Across coarse-grained granitic dike (pegmatite?) at collar of shaft. Some iron- and manganese-oxide stains-----------	.045	.073	.135	.0081	.0063
5	do----	2.5	Punky to slightly silicified shear and gouge zone in gneiss; some stringers of hematite with relict sulfides--------------	.287	.093	.266	.010	.017
6	do----	4.0	Across two coarse-grained pegmatite dikes with 1 ft of sheared gneiss country rock; some copper-, iron-, and manganese-oxide stains-------------------------------------	.075	.035	.156	.0031	.0047

Data for samples shown in figures A-24 and A-25--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
7	Random chip--	NA	Through 35 ft of gneissic country rock with porphyritic andesite and pegmatite dikes---	0.005	0.003	0.0049	--	--
8	Chip--	2.0	Across pegmatite dike composed of quartz and potassium feldspars with minor copper minerals and manganese oxides along fractures	.031	.038	.229	--	--
9	do----	6.5	Across an irregular coarse-grained, igneous dike with some secondary copper mineral stains; some fine-grained dike rock included------------------------------------	.142	.019	.128	--	--
10	do----	1.1	Across pegmatite (?) dike truncated by shear. Dike is medium- to coarse-grained quartz and potassium feldspar; finer grained near the margins. Minor secondary copper minerals observed------------------------	.107	.038	.38	--	--
11	Random chip--	NA	Through 32 ft of gneissic country rock with minor amounts of pegmatite (?) and andesite dikes--------------------------------------	.0006	.008	.0022	--	--
12	do----	NA	Small zone of irregular pegmatite pods and veinlets with minor, disseminated pyrite and chalcopyrite--------------------------	N	.003	.0007	--	--
13	Chip--	3.3	Across shear zone in gneiss with some breccia and gouge; contains minor coarse-grained igneous veinlets and calcite cavity fillings	.003	.003	.0015	--	--

Data for samples shown in figures A-24 and A-25--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
14	Random chip--	NA	Through 36 ft of punky, mylonitized gneiss with small, coarse-grained igneous pods and stringers and earthy to specular hematite along fractures-------------------	0.0006	0.0009	0.0006	--	--
15	do----	NA	Intensely bleached, sericitized, and sheared zone in gneiss with some relict iron-oxide stained pegmatitic structures in pods------	N	.02	.002	0.089	0.021

NAME: Tough Nut mine

OWNER: P. K. Roman (Romans Rainbow 1 and 2); Gar Watts and others (Dan 1 and 2).

INDEX MAP NO.: Plate 1, no. 112

LOCATION: SW1/4 sec. 30, T. 11 N., R. 14 E., S.B.M. The claims are located on a parcel of land which is segregated from mineral entry under the general mining laws.

ELEVATION: 4,500 to 4,750 ft

ACCESS: From Kelso, CA, 3.5 mi northeast on the paved Kelso-Cima Road, then approximately 7 mi east on four-wheel-drive roads and 0.4 mi by foot.

HISTORY: The upper workings of the Tough Nut mine are thought to have been first developed in the 1870's or 1880's and the lower adit driven by Latham in the 1930's (fig. A-26) (Richard Greenwood, personal commun., 1983). Crawford (1896, p. 329) described a 60-ft shaft and superficial workings as owned by Charles Stilson and others. A location notice for the Tough Nut mine was recorded with San Bernardino County in February 1900 by John Domingo and C. A. Stilson. Adit 4 (figs. A-27 and A-28) was located as the Copper Head in 1953. In 1982, the two claim groups on the property were in apparent conflict: the Romans Rainbow 1 and 2 claims were located in June 1978 by Patrick Roman, and the Dan 1 and 2 claims were located in March 1981 by Gar Watts, Ralph Atkinson, and the Piute Canyon Mines, Inc.

PREVIOUS PRODUCTION: No production was recorded. Based on the presence of stopes, the remains of a millsite, high assay values, and the proximity of past producers with similar environments (Bonanza King mine, plate 1, no. 146), minor past production is likely.

GEOLOGY OF DEPOSIT: Most of the upper workings are in Paleozoic (Hazzard, 1954) carbonate rocks near a contact with underlying shale. The mineralized zones are replacement bodies associated with fissures and solution cavities in the carbonate rocks. The primary replacement body, exposed in the main working (shaft 3, figs. A-27 and A-28), varies greatly in attitude but appears to coincide with an east-trending, south-dipping fault. This fault offsets shale and quartzite 200 ft northeast of the shaft and is exposed in adit 4 (fig. A-28). Alteration associated with the mineralized zones is limited to replacement of the carbonates. Very few sulfides were observed. Lead probably occurs as cerussite or anglesite ($PbSO_4$). The primary gangue mineral is calcite. Barite stringers were observed, but only minor amounts were detected in assays. In the lower working, which is in shale, quartzite, and quartz-sericite schist, there is some disseminated pyrite; pyrrhotite (FeS) was detected by microprobe analysis in samples taken from this area.

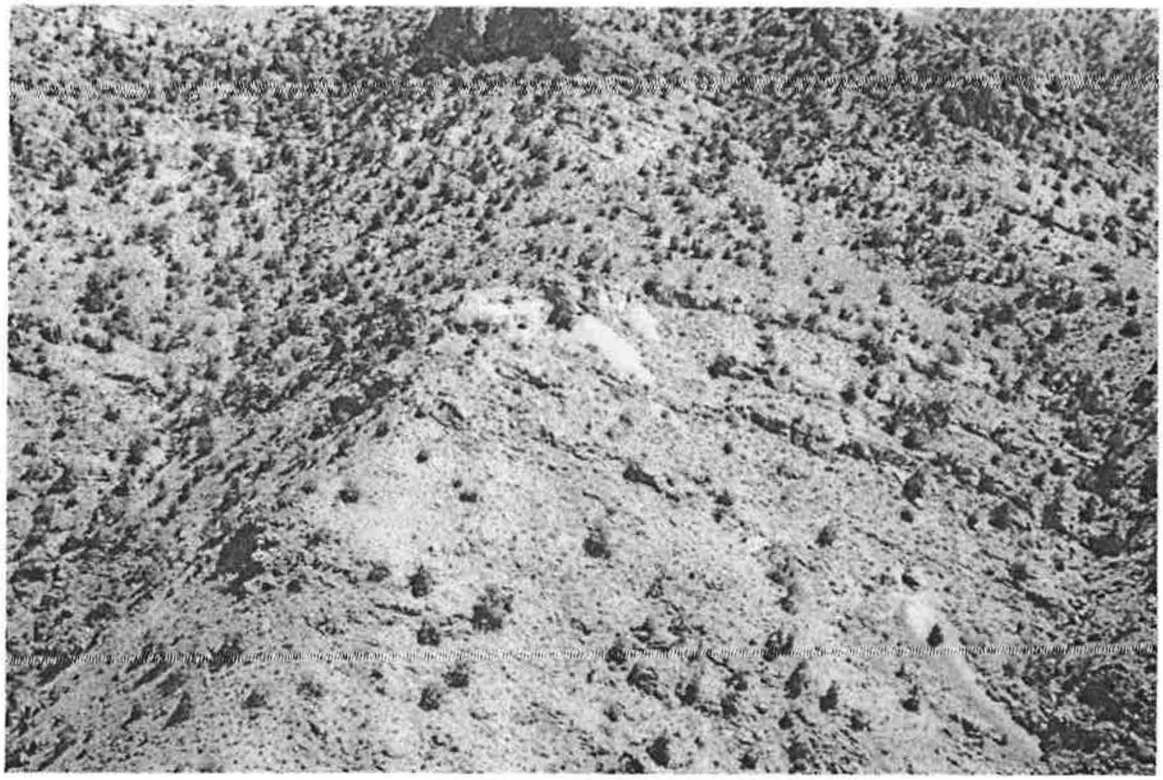


Figure A-26--The Tough Nut mine (viewed toward the south); main workings at center of photograph and lower working (adit 1) at lower right

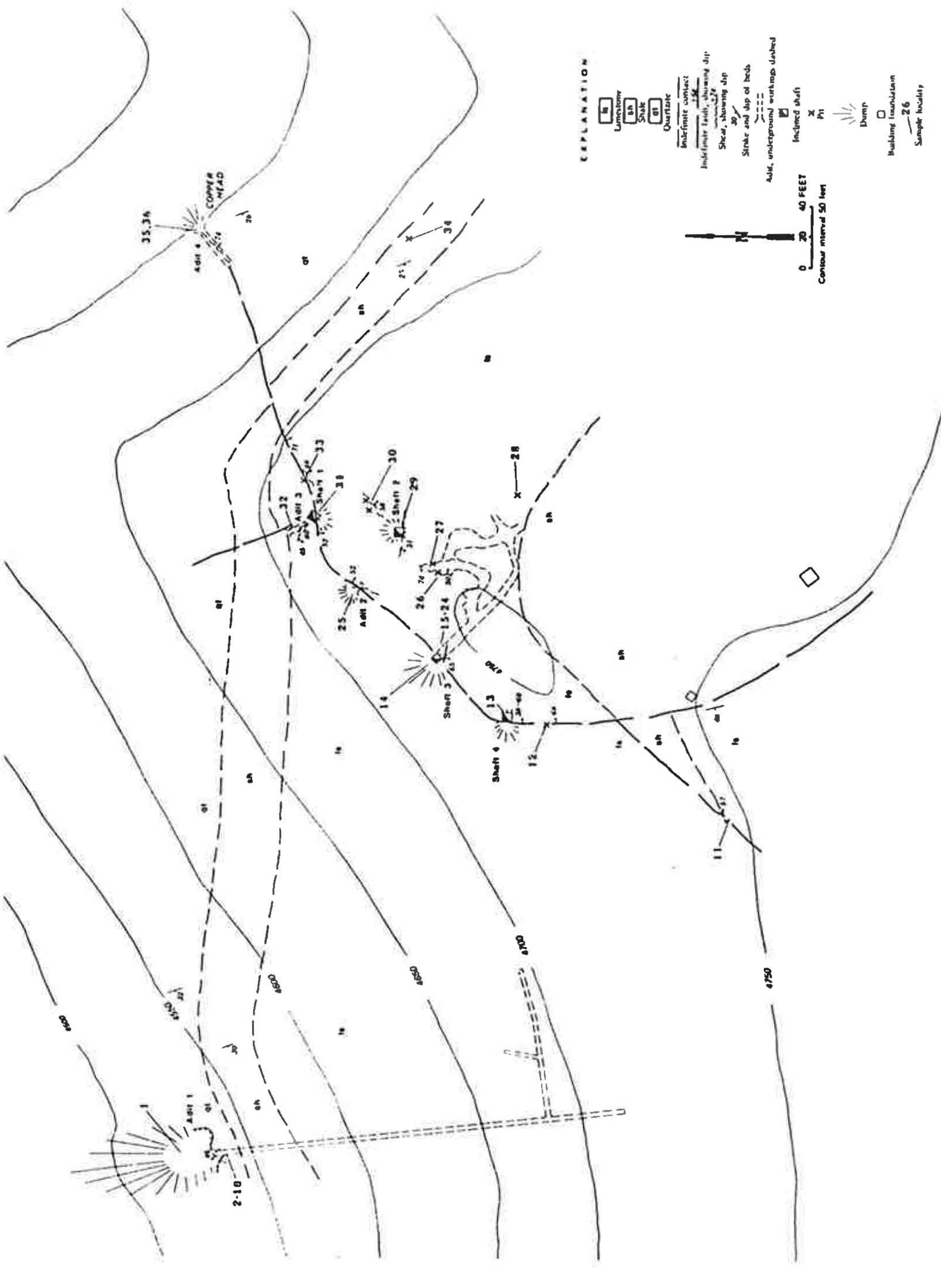


FIGURE A-27—Surface map, Tough Nut mine

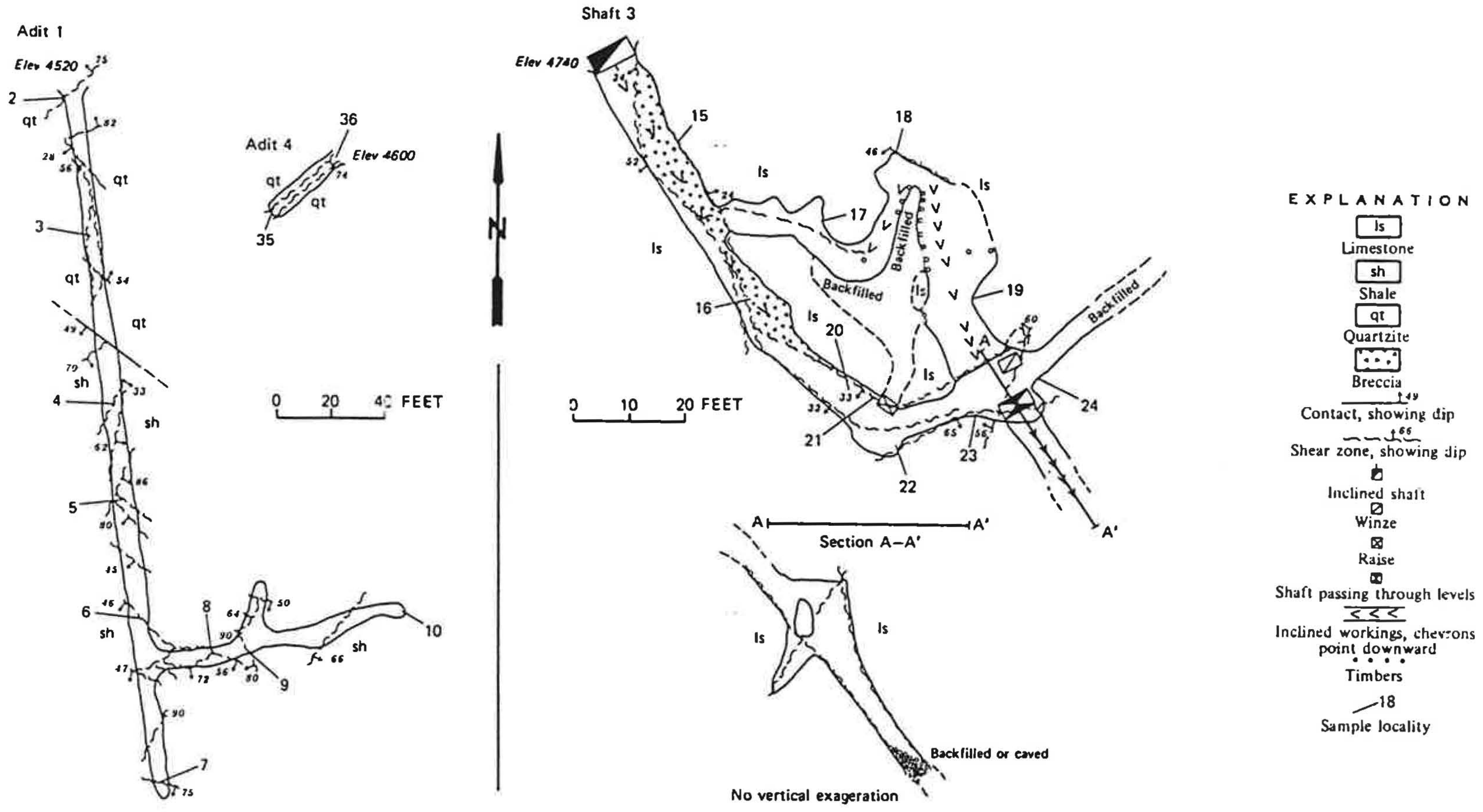


FIGURE A-28—Underground maps, adits 1 and 4, shaft 3, and section A-A', shaft 3, Tough Nut mine

Data for samples shown in figures A-27 and A-28

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
No.	Type	Length (ft)	Description						
1	Grab--	NA	Quartzite, phyllite, and some limestone with minor iron-oxide stains----------------------------	N	N	N	0.02	0.02	--
2	Chip--	3.6	Across fault intersection composed of gouge and quartzite breccia; includes 0.5 ft on hanging wall and footwall--------------------------	N	N	0.0018	.003	.0029	0.05
3	do----	2.7	Across two shear surfaces with 3 to 4 in. of iron-oxide stained, altered material along each surface and unaltered quartzite between the shears----------------------------	N	N	.001	N	.0038	--
4	do----	4.5	Across moderately hard to soft, green to buff siltstone between structures; some sulfide smell-----	N	N	.0026	.003	.0078	.08
5	do----	3.5	Across several intensely iron-oxide stained, intersecting shear zones with pyrite pseudomorphs along fractures; some secondary copper minerals along fractures-----------	N	N	.015	.0023	.0063	--

Data for samples shown in figures A-27 and A-28--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
6	Chip--	2.0	Across 1.0 ft green, punky shale with pyrite, 0.5 ft iron-oxide stained silicified gouge and 0.5-ft green silicified siltstone---------------	N	N	0.0048	0.011	0.035	0.06
7	do----	2.0	Across thin shear zone; some limonite in shear zone with fractures and alteration within 0.5 ft on each side. Rock is dark gray argillite (?) with light green silicified bands (chert?).	N	N	.0018	.003	.0032	--
8	do----	1.6	Across structure in gray shale above quartzite with iron-oxide stains. Shale has stringers of disseminated pyrite----------------------------	N	N	.0043	.0023	.005	.05
9	do----	2.0	Across thin shear zone on right rib. Some secondary copper minerals and iron-oxide within 1 ft on either side of shear--------------------------	N	N	0.012	0.0023	0.0056	--
10	do----	3.0	Across slightly fractured, iron-oxide-stained quartzite at working face; no apparent structure--------------	N	0.1	.007	.0037	.0041	--

Data for samples shown in figures A-27 and A-28--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
11	Chip--	5.0	Across carbonate-bearing, bleached gouge zone above fault surface with shale chips in gouge. Fault surface is encrusted with iron oxides------	N	0.2	0.0009	0.0066	0.0041	--
12	Random chip--	NA	Across light gray to tan limestone adjacent to shear zone. Chert and coarsely crystalline calcite are in the limestone with iron oxide along fractures-------------------------	0.01	.4	.0015	.092	.086	--
13	Chip--	1.8	Across massive to fractured, gray limestone (1.5 ft) and 0.3 ft of iron-oxide stained, bleached limestone adjacent to fault--------	.09	.8	.0027	.195	.154	--
14	Grab--	NA	Limestone with coarser calcite in fractures and considerable limonite staining. Vuggy in places----------	.649	8.4	--	1.0	.38	--
15	Chip--	1.0	Intensely bleached, iron-oxide stained, brown to gray, fractured and brecciated limestone with some sulfide boxworks; structure pinches to fault trace 3 ft up incline-----	2.01	67.2	.035	2.92	.0005	--

Data for samples shown in figures A-27 and A-28--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
16	Chip--	3.8	Across fractured and brecciated limestone in gouge and iron oxide with calcite----------------------	N	0.5	0.0017	0.110	0.067	N
17	do----	2.3	Limonitic limestone with coarse calcite in upper 1 ft and gray limestone with white stringers in lower section---------------------	N	.8	.0025	.179	.159	--
18	do----	2.1	Across fractured, contorted limestone with iron oxide filled fractures between hanging wall and footwall--	N	N	.0013	.084	.097	N
19	do----	4.0	Vuggy, limonitic limestone in upper 1 ft and fractured gray limestone in lower 3 ft------------------------	0.02	.1	.0033	.142	.069	--
20	Random chip--	NA	Red fracture filling material that coats fractures and is powdery; grades into yellow-brown powder at top---------------------------------	N	N	.0011	.0092	.028	--
21	Chip--	4.3	Across fractured zone between hanging wall and footwall. Some limonite within 1 ft of hanging wall and black "powder" near footwall-------	Tr	.4	.0012	.056	.090	--

Data for samples shown in figures A-27 and A-28--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
No.	Type	Length (ft)	Description						
22	Chip--	2.0	Iron-oxide stained, fractured limestone above hanging wall; bounded by secondary slip surfaces sub-parallel to hanging wall-------	0.01	0.3	0.0046	0.120	0.096	N
23	do----	3.8	Six in. of breccia adjacent to hanging wall; 6 to 8 in. of iron-oxide stained, vuggy gouge adjacent to footwall, and "flowstone" in the fractures; limestone is dark gray with white stringers---------------	.01	.8	.0082	.397	.49	N
24	do----	6.0	Fractured gray calcite-healed limestone zone 4.5 ft thick bounded by 0.2 ft (hanging wall) and 1.3 ft (footwall) of brecciated, iron-oxide encrusted limestone----------------	Tr	.2	.0024	.066	.045	N
25	Random chip--	NA	Slip plane in fractured, calcite healed, gray limestone; hanging wall fractured, leached, and iron-oxide stained---------------------------	.06	4.9	.009	1.23	.0005	N
26	Chip--	1.5	Across footwall below small shear zone; gray limestone with white, recrystallized zones---------------	N	.2	.0012	.048	.053	0.05

Data for samples shown in figures A-27 and A-28--Continued

Sample									
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
27	Chip--	1.1	Across slip plane crosscutting limestone bedding; fault partially healed with calcite; hanging wall bleached, honey combed, and iron-oxide stained---------------------	0.04	2.7	0.0086	1.31	0.0008	0.06
28	Random chip--	NA	Carbonate cemented breccia (?) with clasts of brown shale; limestone breccia has many white fracture fillings--------------------------	.003	.05	.006	.046	.039	.05
29	Chip--	2.0	Across fractured to brecciated limestone along fault surface------	.01	.6	.0013	.025	.045	N
30	do----	1.5	Slightly punky, brecciated, calcite healed limestone cut by fault; zone is bleached with many small cavities. Massive barite found in fractures----------------------	.0012	.015	.0026	.036	.086	.04
31	do----	1.9	Across shear with punky gouge zone; country rock is dolomitic limestone with white stringers---------------	.126	.525	.010	.354	.273	N
32	do----	2.0	Across intersection of two structures in shale and quartzite; punky gouge with shale, quartzite, and limestone fragments in breccia---------------	.02	1.6	.0065	.50	N	.03

Data for samples shown in figures A-27 and A-28--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)	Barium (%)
No.	Type	Length (ft)	Description						
33	Chip--	1.0	Across shear zone in limestone. Quartz and calcite stringers parallel to shear in adjacent rock	0.0039	0.384	0.006	0.096	0.148	0.04
34	do----	1.8	Green shale to fossiliferous carbonate-bearing sediment; beds are thinly laminated, contorted, and iron-oxide stained------------	N	.025	.0028	.003	.145	--
35	do----	3.2	Shattered, punky, bleached, iron-oxide stained quartzite between shear surfaces with 0.5 to 2 in. of bleached gouge-----------------	.005	.012	.0062	.0023	--	--
36	do----	2.5	Fractured, punky to hard, bleached iron-oxide stained, fine-grained quartzite between hanging wall and footwall----------------------	N	N	.0007	.0016	.002	--

WORKINGS AND FACILITIES: The lower working is an adit with two side drifts totaling 360 ft (fig. A-27 and A-28). The upper workings consist of three adits totaling 46 ft, four inclined shafts (one flooded) totaling at least 300 ft, and nine pits. The remains of several old stone buildings are located south of the main mine area. Miners' quarters and a possible millsite are located 0.4 mi northwest of the mine.

SAMPLING: Two grab, 4 random chip and 30 chip samples were taken on the property. Sample locations are shown on figures A-27 and A-28, and sample descriptions and assay results are listed in the accompanying table. Of 26 samples from the upper workings, 18 contained gold, and 23 contained silver. Gold values ranged from a trace to 2.01 oz/ton, but only 3 contained more than 0.1 oz/ton gold. Silver values ranged from 0.012 to 67.2 oz/ton; 5 contained more than 1.0 oz/ton silver. Of 10 samples from the lower working, one contained 0.1 oz/ton silver and no gold. Lead ranged from 0.0016 to 2.9 percent, zinc ranged from 0.0005 to 0.49 percent, and copper ranged from 0.001 to 0.035 percent.

CONCLUSIONS: Due to the irregular structure and the sporadic assay values, no resources are identified. The similarity of the geologic environment to nearby past producers (Bonanza King and Silver King mines) and the scattered high assay values suggest the property merits further investigation for gold, silver, lead, and possibly zinc resources at depth.

NAME: Black Jack mine

OWNER: Frank and Barbara Kirnig

INDEX MAP NO.: Plate 1, no. 118

LOCATION: NE1/4 sec. 36, T. 11 N., R. 13 N., S.B.M. The Black Jack mine patented property, as shown on the Mineral Survey (4693) plat and BLM land status maps, lies approximately 1,600 ft east of the actual mine location.

ELEVATION: 4,120 to 4,160 ft

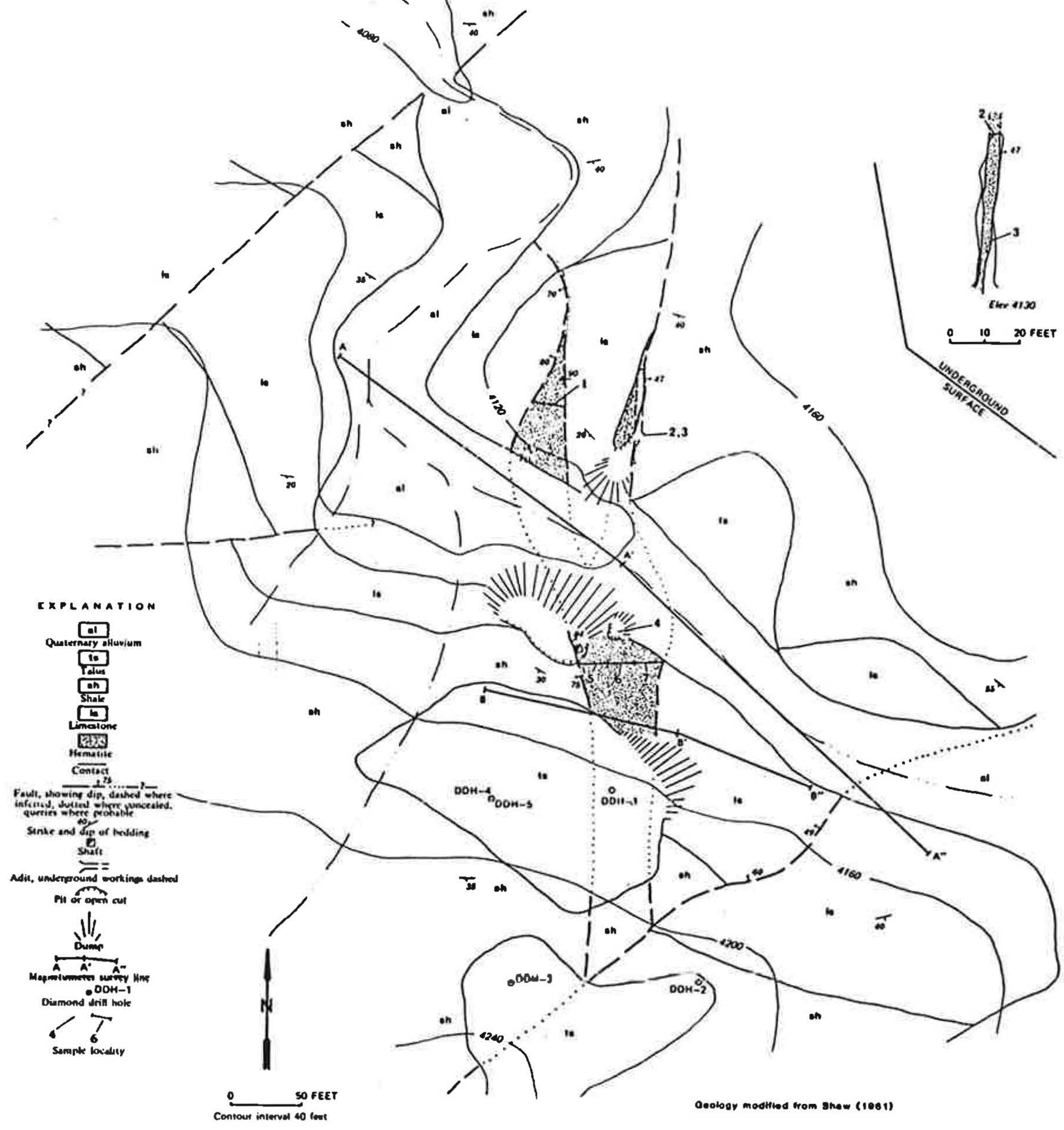
ACCESS: From Kelso, CA, 3.5 mi northeast on the Kelso-Cima Road, then 4.8 mi southeast toward the Tough Nut mine, then 1/2 mi southwest cross-country to the mine site.

HISTORY: According to San Bernardino County records, the Black Jack group of 12 claims was located by Messrs. Geldmacher and Stilson in 1901. The Los Angeles Mining Review (Jan. 31, 1903) noted that a shaft was 112 ft deep in 1903. Under the ownership of the Providence Mountain Mining Co., the Black Jack mine claim was surveyed in 1908 (Mineral Survey 4693) and patented in 1913 (Pat. No. 310550). No further activity was noted until approximately 1960 when the Foothill Mining Co., Inc. took a lease option on the property, located eight claims around the Black Jack mine, and conducted an evaluation of this deposit and the Cornfield Springs Consolidated mine (plate 1, no. 121). Within a period of two months in 1961, surveying, geologic mapping, sampling, vertical intensity magnetic surveys, and diamond drilling were conducted on the property. After the development of a mine plan, no subsequent exploration or development work was done.

GEOLOGY OF DEPOSIT: The deposit occurs as a fault-bound lens or pod in limestone and shale. The geology as shown on figure A-29 is modified from a consultant report by Shaw (1961). Precambrian gneissic rocks, thought to be underlain at shallow depths by granitic rocks, crop out approximately 3/4 mi to the northwest and 400 ft lower in elevation.

The major iron-bearing mineral is specular hematite with minor magnetite and earthy limonite. One outcrop contains specular hematite, disseminated pyrite, sulfide boxwork, and sulfur encrustations. The deposit crops out for approximately 300 ft in a north-south direction, is 60 ft thick at the largest outcrop, and is overlain by shale to the south. The northern third of the deposit splits into two lenses or stringers 15 and 40 ft thick. Minor pods and stringers of specular hematite are in limestone to the east, west, and north of the deposit.

The deposit contains sufficient magnetite to elicit up to a 180 gamma anomaly response during a total intensity magnetic survey conducted by the USBM during the fall of 1982 (fig. A-30). The survey confirmed the



Geology modified from Shaw (1961)

FIGURE A-29—Surface and underground maps, Black Jack mine

Data for samples shown in figure A-29

[N, none detected; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Iron (%)	Phosphorus (%)	Sulfur (%)	Manganese (%)	Magnesia (MgO) (%)	Lime (CaO) (%)	Titania (TiO_2) (%)	Silica (SiO_2) (%)	Alumina (Al_2O_3) (%)
No.	Type	Length (ft)	Description											
1/ 1	Random chip--	NA	Through 20 ft of specular hematite pod with minor earthy hematite------	N	N	60.3	0.05	0.12	0.0082	0.29	0.45	0.02	3.0	0.84
2	Chip--	1.5	Breccia zone along limestone-shale contact; predominantly specular and earthy hematite fragments; calcite veinlets in the limestone---	0.04	0.3	41.8	.09	.21	.052	.46	9.4	.15	14.6	3.8
3	do----	2.5	do-----------------------------------	.06	.1	28.0	.07	.09	.33	2.9	.96	.31	29.6	11.0
4	do----	4.5	Fractured pod of nodular specular hematite contains disseminated pyrite, boxworks, and sulfur encrustations--	.01	N	48.2	.04	.54	.0046	.68	.09	.05	29.8	1.2
5	Random chip--	NA	Through 20 ft of hematite from shale contact----------------------------	.02	N	51.5	.04	.11	.006	.24	.30	.04	24.1	.9
6	do----	NA	Continuation of sample 5: through 20 ft of hematite------------------	.01	.1	54.5	.02	.22	.003	.15	.07	.03	12.7	.76
7	do----	NA	Continuation of sample 6: through 20 ft of hematite to limestone contact----------------------------	N	.1	57.4	.03	.08	.0066	.16	.26	.02	4.1	.81

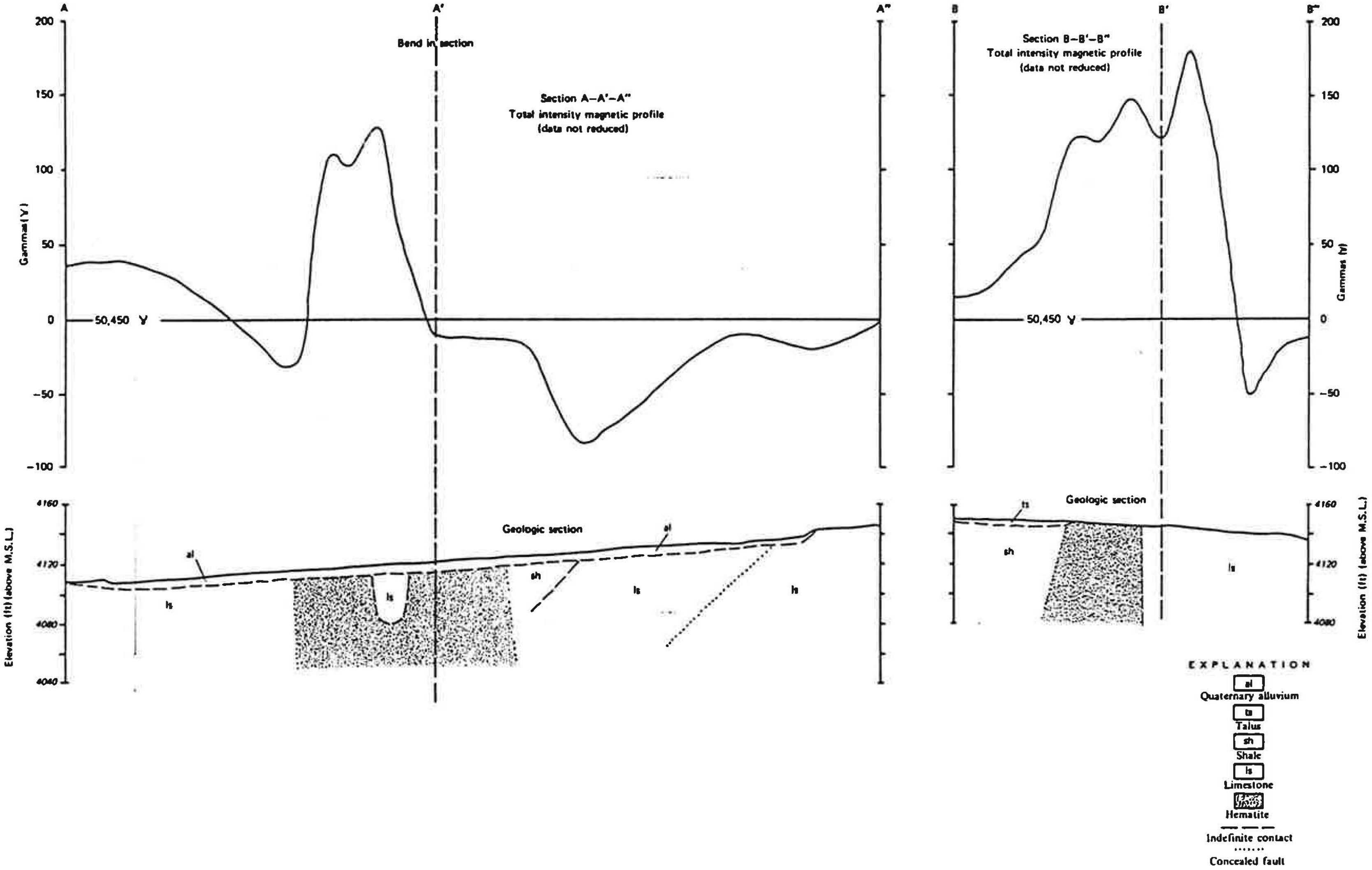


FIGURE A-30—Total intensity magnetic profiles and geologic sections, A-A'-A" and B-B'-B", Black Jack mine continuity of the deposit across the wash and indicated that it dips steeply to the east near the center and steeply to the west in the southern third of the deposit.

WORKINGS AND FACILITIES: Workings, shown in figure A-29, consist of a 45-ft-long adit and a 115-ft-deep shaft, both present when the property was surveyed in 1908, and two pits excavated when the deposit was evaluated in 1961 (Shaw, 1961, p. 6). The shaft is too dangerous to access. Six diamond drill holes were made during the 1961 evaluation; depths ranged from 47 ft to 150 ft. Owners prior to 1960 alleged the shaft was 475 ft deep; however, this is not substantiated by the size of the dump or drill intercepts. Approximately 6 mi of road were bulldozed from the old Kelso reservoir to the mine site in 1961, but the road was not passable in 1982.

SAMPLING: Analyses of seven chip and random chip samples taken on the property are shown in the table which accompanies figure A-29. One sample across the wider lens on the north side of the wash and three samples across the width of the main outcrop on the south side of the wash (fig. A-29) contained from 52 to 60 percent iron. Samples 2-4 contained only 28 to 48 percent iron along with minor amounts of gold, but they are not representative of a majority of the deposit because both samples 2 and 3 are from the breccia zone exposed in the adit, and sample 4 is from a small zone of disseminated pyrite. Three samples taken in 1961 across the main outcrop near the shaft ranged from 56 to 58 percent iron (Shaw, 1961, p. 6).

RESOURCE ESTIMATE: Foothill Mining Co. estimated the deposit contained about 160,000 long tons of indicated resources averaging 58 percent iron at a stripping ratio of 1:4.9 (ore to waste ratio by volume). Mining of the deposit by open-pit methods to a depth of 72 ft was assumed. The calculations were based on cross-sections from a surface geologic map, magnetic surveys, and six diamond drill holes (locations of five holes are shown on figure A-27).

Using the same data, but not being constrained by the maximum 72 ft depth of the open pit plan, an indicated resource of 230,000 long tons is estimated at a grade range of 55 to 60 percent iron. The calculation is based on a strike length of 350 ft, a thickness which ranges from 50 to 80 ft, a depth which ranges from 35 to 145 ft, and a tonnage factor of 8 ft^3/long ton. Due to geologic constraints identified by geologic mapping and drilling, the deposit is not inferred to project to the north, south, or to depth.

CONCLUSIONS: Due to the small size of the deposit, the rough terrain in the vicinity, the long transportation distance to prospective markets, and the depressed state of the iron industry in 1984, this deposit has a very low probability of being developed. Although the contact metasomatic environment responsible for the deposit was widespread along the western front of the range, the Black Jack mine deposit is probably fault-bound, and there is no indication that additional resources are present.

NAME: Cornfield Springs Consolidated mine

OWNER: Frank and Barbara Kirnig

INDEX MAP NO.: Plate 1, no. 121

LOCATION: NW1/4SE1/4 sec. 11, T. 10 N., R. 13 E., S.B.M. Located adjacent to study area within a cherry-stem exclusion. A portion of the patented claim group is included within the study area boundary.

ELEVATION: 3,300 to 3,430 ft

ACCESS: From Kelso, CA, 4 mi southeast on a four-wheel-drive jeep trail with many washouts, then approximately 3/4 mi southeast by trail to the mine site.

HISTORY: The first claim location on the property was not found; however, the San Bernardino County records indicate that it was relocated as the Plano claim by Stilson in 1902 and was again located by Stilson and Hall in 1904 as the Cornfield Springs mine. A Mineral Survey (No. 4692) was conducted in 1908 for the owners, Providence Mountain Mining Co. The Cornfield Springs Consolidated mine, composed of the Cornfield Springs claim, the Pomona claim, and the East Iron Extension mine was patented in 1913 (Pat. No. 310549). The main workings were developed by 1908 (Jones, 1909, p. 788). With the exception of an unpublished evaluation (not available to the authors) prior to 1936, there was no additional reported activity until about 1960 when the Foothill Mining Co. located nine claims around the three patented claims. Results of a subsequent evaluation of the deposit, along with the Black Jack mine (plate 1, no. 118), are not available.

GEOLOGY OF DEPOSIT: Surface expressions of the deposit are pods, lenses, and stringers of massive, specular hematite replacing quartzite and limestone of lower Paleozoic age (fig. A-31). The lowest outcrop of the deposit is probably less than 100 ft above a contact with metaigneous rocks of unknown age. Associated with the specular hematite are vugs of earthy limonite and hematite and calcite veins. The replacement bodies are generally concordant with bedded metasedimentary rocks which strike N. 65° E. and dip 35° SE.; however, specular hematite veins in some places crosscut bedding along localized shear zones. The deposit can be traced by intermittent surface outcrops for about 385 ft, and Hewett and others (1936, p. 79) reported it was cut by workings at a depth of 175 ft. Even though Hewett and others (1936) reported the main surface outcrop body as being 15 ft by 40 ft, the largest outcrop observed is approximately 70 ft long and 20 ft wide. Jones (1909, p. 788) described the deposit as 40 to 50 ft wide and as having been developed for several hundred feet.

WORKINGS AND FACILITIES: A 25-ft-deep inclined shaft, two adits (one 15 ft to a mud fill and the other flooded), and three pits were found on the property (fig. A-31). The Mineral Survey plat shows the two adits as being 65 ft (adit 1) and 635 ft (adit 2) long and that a second shaft, 60

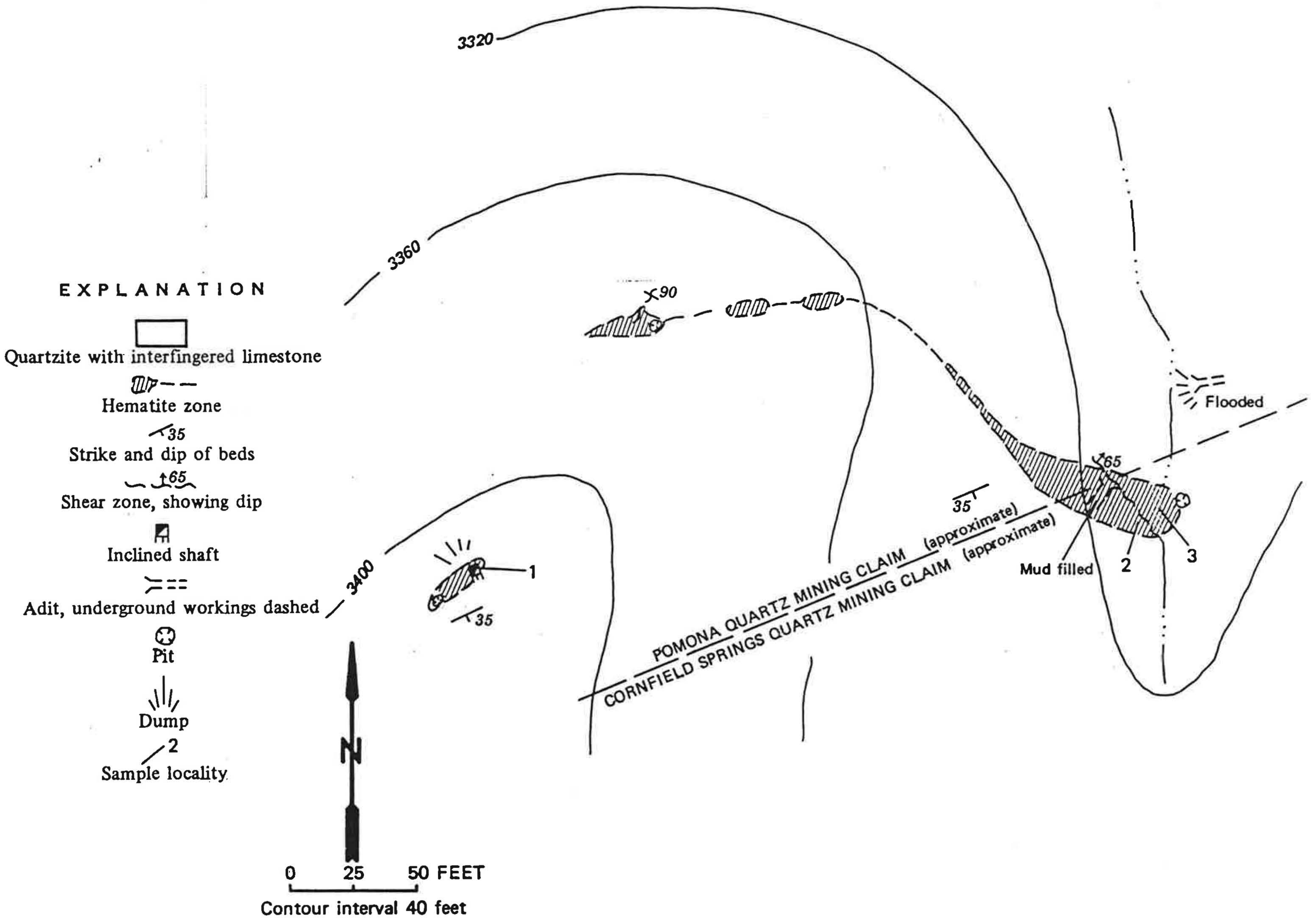


FIGURE A-31— Surface map, Cornfield Springs Consolidated mine

Data for samples shown in figure A-31

[N, none detected; NA, not applicable]

Sample				Iron (%)	Manganese (%)	Magnesia (MgO) (%)	Titania (TiO_2) (%)
No.	Type	Length (ft)	Description				
1	Chip--	6.0	Across a 28-ft-long pod of massive specular hematite interfingered with calcite approximately concordant with quartzite bedding---------------------------------------	26	N	0.2	0.07
2	Random chip--	NA	Through 14 ft of upper section of podiform body of specular hematite in bedded quartzite------	48	0.08	1.7	.10
3	do-----	NA	Continuation of sample 2 for 14 ft-------------	52	.05	1.0	.07

ft deep, was developed east of the main workings. Hewett and others (1936, p. 79) and Wright and others (1953, p. 65 tables) noted a 600-ft-long adit. The second shaft was not found during our investigation.

SAMPLING: Analyses of three samples taken on the property are listed in the table which accompanies figure A-31. A 6-ft chip sample across the upper-most pod contained 26 percent iron, and two random chip samples across the main outcrop averaged 50 percent iron.

RESOURCE ESTIMATE: Due to lack of access to underground workings, the resources of the Cornfield Springs deposit cannot be accurately determined; however, Hewett and others (1936, p. 79) and Wright and others (1953, p. 65-66 tables) reported that the deposit consists of several hundred thousand tons of "reserves" containing 60 percent iron with 0.02 percent phosphorus. Using a cumulative strike length of 385 ft, a depth (downdip) ranging from 0 to 230 ft (115 ft used), a maximum thickness of 20 ft and a tonnage factor of 8 ft^3/long ton, the deposit is estimated to contain approximately 110,000 long tons of resources. Hodge (1935, p. 10) cited the Cornfield deposit as one of several ". . . more or less proven as to size which are too small for the economic establishment of transportation facilities." At least one of the other deposits so described by Hodge, the Iron Age, was subsequently mined by Kaiser Steel in the 1950's and 1960's.

CONCLUSIONS: This deposit contains subeconomic inferred resources of 110,000 long tons of 50 to 60 percent iron. It may contain several hundred thousand long tons in additional resources; however, the relatively small size of the deposit, the rugged terrain, and the current low demand for iron ore are negative factors affecting development.

NAME: Rex mine

INDEX MAP NO.: Plate 1, no. 122

LOCATION: E1/2 sec. 9, T. 10 N., R. 13 E., S.B.M. The Rex mine lies within a 1/4 mi^2 (square mile) cherry stem exclusion from the study area.

ELEVATION: 2,590 to 2,685 ft

ACCESS: From Kelso, CA, 4.2 mi southeast on four-wheel-drive road to the mine site.

HISTORY: The Rex mine was operated in 1939 by Messrs. Clark and Williams and from 1951 through at least 1954 by Clyde Adams, Tom Clark and J. C. Donnelly (Wright and others, 1953, p. 55 tables; USBM statistical files). The Joe claims (at least five) were located by Earl Williams in 1977. Most development work, including installation of a 35-ton ball mill and a 30-ton table, occurred in the early 1950's. The property was not held in 1982.

PRODUCTION: USBM statistical files show that 26 tons of crude ore containing 12 oz gold and 9 oz silver were produced in 1939 and 100 tons of crude ore containing 5 oz gold were produced in 1951. Grades were 0.46 oz/ton gold and 0.35 oz/ton silver in 1939 and 0.05 oz/ton gold in 1951. Wright and others (1953) reported small shipments in 1934 and 1948 and mine development in 1952.

GEOLOGY OF DEPOSIT: The deposit consists of a brecciated quartz- and specular to earthy hematite-bearing vein in a fault zone which strikes N. 25° W. and dips steeply southwest in metamorphosed quartz diorite and subvolcanic rocks of probable Jurassic (Dave Miller, personal commun., 1984) age. Country rock is medium to fine grained and consists of quartz and albitized plagioclase, both are anhedral to subhedral, with minor potassium feldspar and traces of rutile, zircon, chlorite, and epidote in a matrix of brecciated feldspar, quartz, and specular hematite. Crosscutting calcite and barite veinlets were observed in one petrographic sample.

The fault zone is exposed for 170 ft, ranges in thickness from 1 to 7 ft, and averages approximately 5 ft thick (fig. A-32). It lies along a northern projection of a major fault passing through the Vulcan mine and is inferred to correlate with the northwest-trending Hidden Hill fault (Miller and others, 1984a).

The enclosed, brecciated vein pinches on the south, is exposed for 140 ft in the main adit, ranges in thickness from 1 to 4 ft and averages approximately 2.5 ft thick. The vein consists of white to translucent, iron-oxide stained quartz which is brecciated and recemented with banded, earthy to specular hematite.

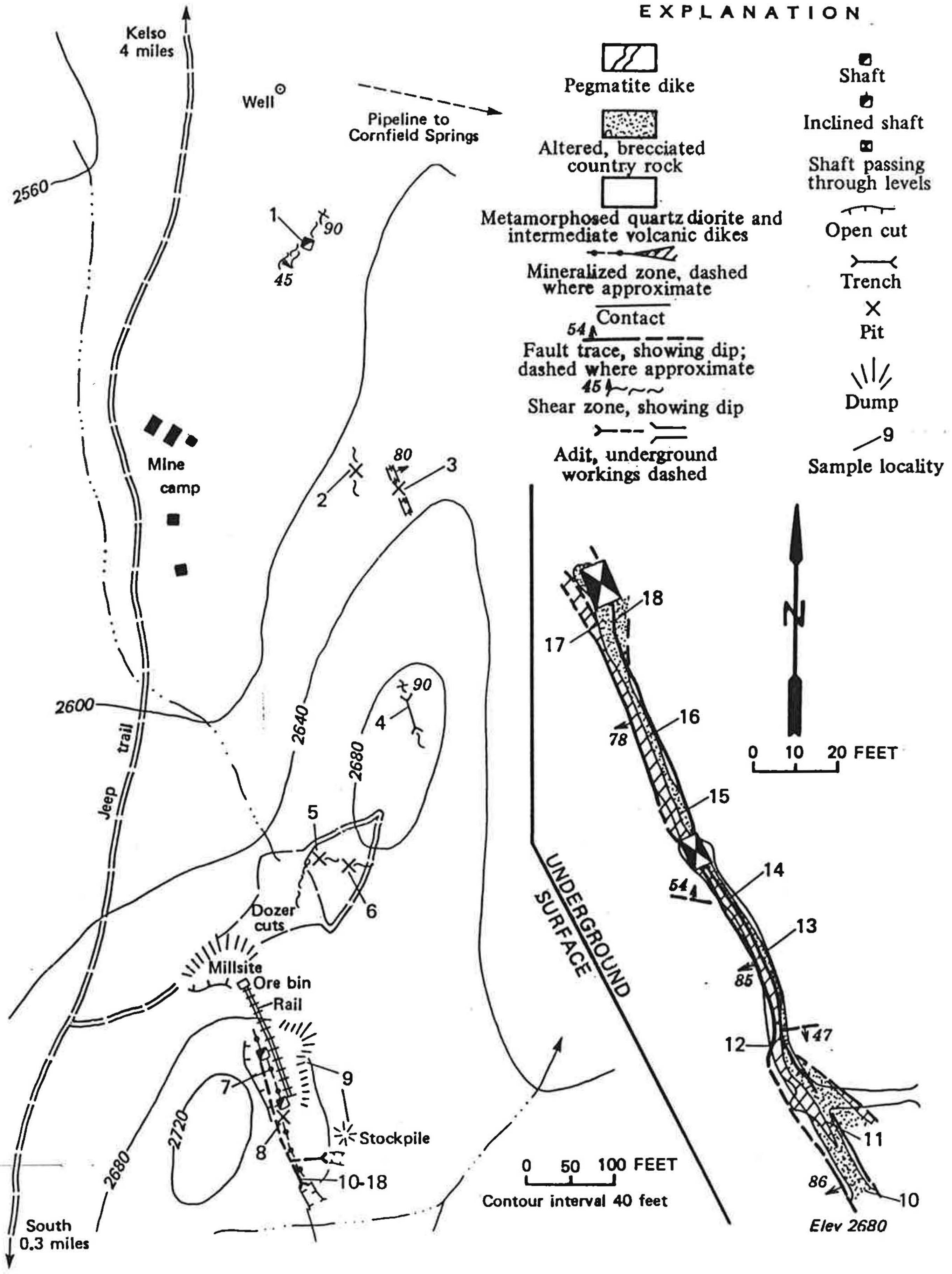


FIGURE A-32—Surface and underground maps, Rex mine

Data for samples shown in figure A-32

[N, none detected; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)
No.	Type	Length (ft)	Description		
1	Select	NA	Metamorphosed quartz diorite with bleached, bladed specular hematite	N	N
2	Chip--	1.0	Banded, iron-oxide zone in sheared metavolcanic rock----------------	N	0.7
3	do----	1.4	Mottled, gray to white pegmatite dike with minor iron-oxide stains in metavolcanic rock-------------	N	.2
4	do----	2.0	Iron-oxide stained shear and gouge zone----------------------------	N	N
5	do----	6.0	Red, earthy hematite-bearing shear zone----------------------------	0.016	N
6	do----	1.5	do--------------------------------	N	N
7	do----	4.0	Friable, red, earthy hematite banded outcrop-------------------------	N	N
8	do----	.8	do--------------------------------	N	N
1/ 9	Select	NA	White to translucent quartz brecciated and cemented with banded, earthy hematite and chalcedony; from dumps and stockpiles----------------------	.072	N
10	Chip--	5.0	Brecciated, sheared, greenstone with minor quartz and iron-oxide stains--------------------------	N	N
*11	do----	1.0	Quartz breccia with limonite veinlets and cement--------------	.230	N
*12	do----	2.5	Quartz breccia with limonite cement and small pods of specular hematite------------------------	.060	N
*13	do----	1.3	do--------------------------------	.480	N

Data for samples shown in figure A-32--Continued

Sample					
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)
*14	Chip--	3.8	Across banded zone of quartz-limonite, quartz-sericite gouge and quartz-hematite breccia------	0.564	N
*15	do----	3.8	do--------------------------------	.126	N
*16	do----	4.0	do--------------------------------	.036	N
*17	do----	1.0	Quartz breccia and limonite vein--	.026	N
18	do----	3.5	Quartz-rich, sheared greenstone---	N	N
1/ 19	Select	NA	Drill cuttings from two drill holes through 2 ft of caliche and into gravel terrace------------------	N	0.006

---

*Samples used to calculate tonnage and grade.

1/ Additional analyses:

Sample 9 = 0.0038% copper
.0037% lead
.0027% zinc

sample 19 = .0014% copper
.0080% lead
.0039% zinc

Other structures on the property consist of northerly trending, near vertical, apparently localized shear zones bearing earthy to specular hematite. South of the adit, the basement rocks are overlain by caliche-capped alluvial fan gravels forming a bajada.

WORKINGS AND FACILITIES: Workings near the mine consist of one adit, three shafts, four pits, and a trench (fig. A-32). The adit consists of a portal with 162 ft of drift, a 20-ft crosscut to a second portal, and two 20-ft shafts, one vertical and the other inclined, connected to the drift. The two shafts are choked with debris at drift level but may join deeper levels. Wright and others (1953, p. 55 tables) noted 300 ft of drift with 30- and 60-ft shafts, and USBM statistical files record 30- and 80-ft shafts. The shaft at the north end of the property is 10 ft deep.

Other developments include a headframe on the south shaft, 140 ft of haulage rail on the upper dump, the remains of an ore bin and a leach tank, and a mine camp composed of five buildings. The remains of a pipeline, possibly from Cornfield Springs, are near the north end of the property. A cased well (?) is near the termination point of the old pipeline. Two trenches, 20 and 30 ft long, are in caliche approximately 1,000 and 2,000 ft south, respectively, of the adit. Two 3-in.-diameter drill holes are at the northern most of the trenches.

SAMPLING: Sixteen chip and three select samples were taken on the property. The sample localities are shown in figure A-32, and sample descriptions and analytical results are listed in the accompanying table. Nine samples contained detectable gold and three contained detectable silver. Seven of nine chip samples from the adit contained from 0.026 to 0.564 oz/ton gold. A select sample collected from a stockpile and dump at the main deposit contained 0.072 oz/ton gold, and a sample of an altered shear zone contained 0.016 oz/ton gold. None of the gold-bearing samples contained detectable silver. One sample from a shear zone contained 0.7 oz/ton silver, a sample from a pegmatite dike contained 0.2 oz/ton silver, and a select sample of drill cuttings contained 0.006 oz/ton silver. Less than 0.01 percent each of copper, lead, and zinc were detected in two select samples analyzed. Six of nine alluvial samples taken from dry washes within 2 mi of the mine contained gold.

RESOURCE ESTIMATE: Gold is restricted to the quartz breccia within the main zone since samples taken across quartz contained gold and those taken from gouge and brecciated country rock were barren. The brecciated quartz is exposed for 140 ft and averages 2.5 ft thick. By projecting the vein 20 ft updip to the surface, and 70 ft both along strike to the north and downdip, the deposit is estimated to contain 3,700 tons with a weighted average grade of 0.22 oz/ton gold. A tonnage factor of 12 ft^3/ton is used. About 200 tons of vein material have been removed.

CONCLUSIONS: At a gold price of $400/oz, the 3,700 ton deposit has a unit value of $88/ton but is too small to mine alone. However, the deposit is structurally controlled by a major fault inferred to extend for at least 12 mi southeast to the Hidden Hill mine, a past producer of gold (Miller and others, 1984a, p. 39). The nature of the structural control, the sample analyses, and gold in nearby washes suggest that additional vein-type gold resources may be present at depth.

NAME: Vulcan mine-Burro prospect

OWNER: Kaiser Steel (Vulcan mine only)

INDEX MAP NO.: Plate 1, no. 128

LOCATION: S1/2 sec. 25, N1/2 sec. 36, T. 10 N., R. 13 E., S1/2 sec. 29, S1/2 sec. 30, N1/2 sec. 31, N1/2 sec. 32, T. 10 N., R. 14 E., S.B.M.

ELEVATION: 3,800 to 5,200 ft

ACCESS: From Kelso, CA, 2.5 mi south on the paved Kelso-Amboy Road, then 6.5 mi southeast and east on the old Vulcan mine haulage road. Travel by four-wheel-drive vehicle is advisable east of the Vulcan mine.

HISTORY: The Vulcan deposit was discovered by Charles C. Jones in 1906 (Jones, 1909, p. 785). One lode claim was patented in 1908, and four additional lode claims and a millsite were patented in 1919. The property was reported (Tucker, 1924, p. 43) to have come under control of the Pacific Coke and Coal Co., but Mr. Jones was again listed as owner in 1930 (Tucker and Sampson, 1930, p. 264; 1931, p. 336-337).

In 1942, the property was sold to Kaiser Steel, Inc. Kaiser developed the property and began production on December 1, 1942. The mine was to produce until the Eagle Mountain mine was brought on line (Bain, 1945, p. 162). Production ceased in July, 1947 (Wright and others, 1953, p. 100). During 1953 and 1957, small tonnages were reportedly produced (Moore, 1971, p. 79), some of which may have been used as aggregate in concrete for atomic shielding (Davis and others, 1959, p. 235). In the 1960's, U.S. Steel located the Burro claims around and east of Kaiser Steel's property and explored a possible extension of the deposit which was indicated by an east-trending magnetic anomaly.

Kaiser Steel maintains 12 active unpatented mining claims as a buffer around the patented Vulcan mine claims. Three of these claims lie partially within the study area.

PRODUCTION: Total production from the Vulcan mine from 1942 to 1947 was 2.643 million long tons of blast furnace grade ore containing more than 50 percent iron (Wright and others, 1953, p. 100). The ore was shipped to the Kaiser Steel Mill in Fontana, CA, (Mining World, 1943, p. 3; Ramsay, 1944, p. 423). Production from later years is not recorded, but is thought to be quite small in comparison.

GEOLOGY OF DEPOSIT: The Vulcan mine ore body occurs along a northwest-trending fault, a possible northern extension of the Hidden Hill fault (Miller and others, 1984a), between Paleozoic dolomitic carbonate rocks (Hazzard, 1954) on the north and intrusive granitic rocks on the south. Hazzard (1954) identified the intrusive rock as a syenite, but Miller and others (1984a) classified the rock by modal composition as a quartz monzonite and date the rock by K-Ar analysis of biotite as Jurassic age.

The ore body is composed of magnetite, subordinate hematite, and minor amounts of limonite and pyrite. The upper, oxidized portion of the ore body consists mostly of hematite and limonite. Major gangue minerals are serpentine and lesser amounts of calcite. Disseminated magnetite is also found in the carbonate rocks some distance from the ore body. The mineral assemblage is typical of magnesium silicate skarns described by Einaudi and others (1981, p. 332-333).

The main ore body is approximately 700 by 325 ft and has an ovoid shape (Wright and others, 1953, p. 100). Exploration diamond drilling indicates the deposit extends to a maximum depth of 900 ft (Severy, 1948, p. 5). It is covered by fanglomerate on its western end. Lamey (1948, p. 90) described a poorly exposed, smaller body lying southeast of the main deposit. It is approximately 700 ft long and 50 to 75 ft wide. Aeromagnetic data (U.S. Geological Survey, 1981) shows an ovoid-shaped, 3,000 gamma anomaly centered on the main deposit. It terminates on the north, south, and west, but is elongate to the east as a 1,000 gamma anomaly.

WORKINGS AND FACILITIES: Original exploration of the ore body included several hundred feet of drifts, shallow shafts, and trenches as well as exploratory diamond drilling. Later, open-pit mining obliterated most of the underground workings. The main pit is 1,000 ft long and 500 ft wide with pit walls 100 to 250 ft high. Moore (1971, p. 81) noted the overall stripping ratio as 1.4:1.0 (weight basis) with pit wall slopes of 1:1 in waste and 0.5:1 in ore. Large dumps and stockpiles are located on the south and west (fig. A-33). A small open pit, a north-trending exploration adit, and numerous pits and trenches are developed as far as 2.5 mi east (plate 1, nos. 134 and 136) of the main pit. The remains of a mill and miners' quarters are on the southeast side of the property. In addition, several miles of drill roads are developed to the north and east.

SAMPLING: Kaiser Steel denied the USBM permission to enter the property; therefore, no samples were taken from the Vulcan mine area. The original samples of the Vulcan deposit indicated an ore grade of 64.8 percent iron (Cloudman and others, 1919, p. 820-821). Based on premining analyses of surface, adit, and drill samples, Lamey (1948, p. 91) reported the average composition of the main ore body as follows:

Fe	P	Mn	SiO_2	Al_2O_3	CaO	MgO	S	TiO_2	LOI
				(weight percent)					
50.69	0.063	0.11	3.89	1.45	6.30	5.18	1.19	0.20	8.60

RESOURCE ESTIMATE: Resource estimates are based on published data. Lamey (1948, p. 94) estimated the total reserves of the Vulcan deposit at 5.68 million long tons containing about 50 percent iron. The total consisted of 1.16 million long tons of measured ore, 1.13 million long tons of indicated ore, and 3.39 million long tons of inferred ore. In addition, he estimated that 43 percent of the total reserve could be

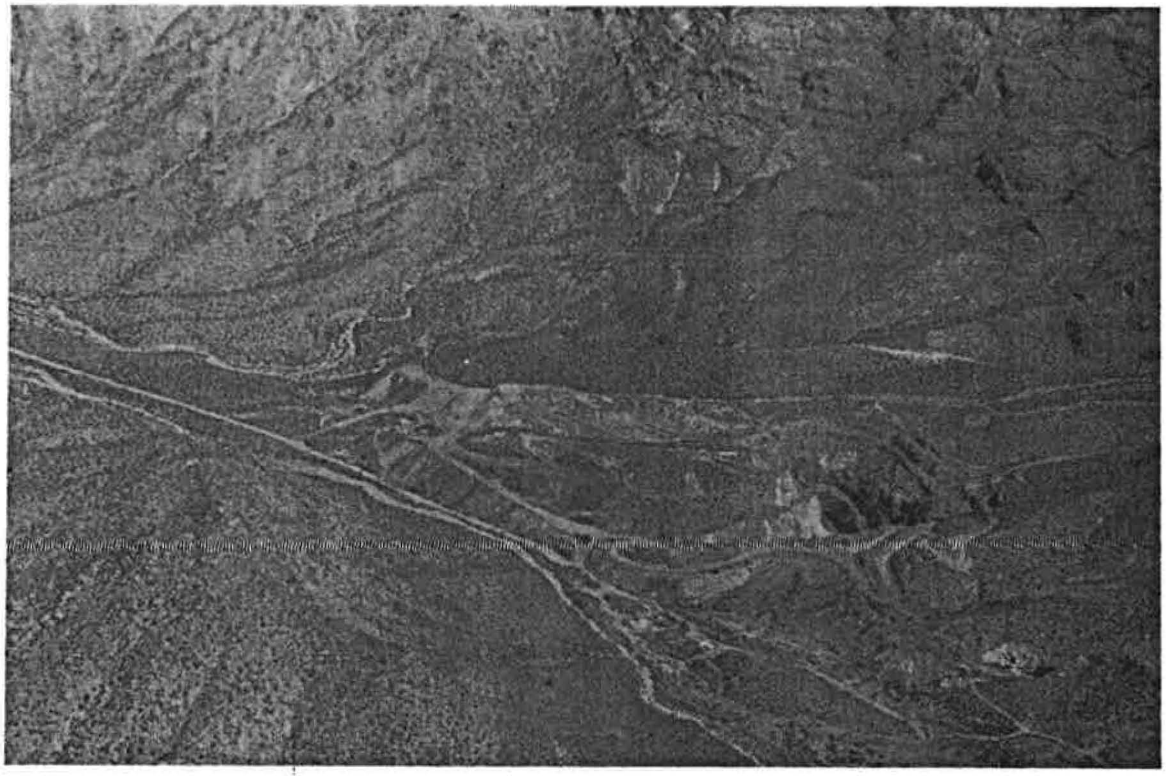


Figure A-33--The Vulcan mine veiwed toward the north-northwest. Bedded limestone and dolomite crop out in the upper right portion and quartz monzonite crops out on the left and foreground.

mined by open-pit methods. Actual total production equaled 47 percent of the reserve estimate. By subtracting the total production (2.643 million long tons) from the original reserve figure (5.68 million long tons), it is estimated that an inferred subeconomic resource of 3.0 million long tons containing 50 percent iron remain in the main deposit. Moore (1971, p. 81) stated:

> The horizontal cross section of the ore body decreased at depth and the stripping ratio required to continue operations on a 1:1 slope is about 7:1 and would increase with additional depth.

The high stripping ratio almost certainly precludes open-pit mining. Lamey (1948, p. 94) estimated that the smaller, detached ore body to the east contains 315,000 long tons.

CONCLUSIONS: Resources minable by open-pit methods were removed. Previous engineering studies indicate that substantial resources remain within and near the main deposit. Aeromagnetic surveys and a fault contact indicate that additional resources may be present further to the east, along the boundary of a south extension of the study area in sec. 31, T. 10 N., R. 14 E., S.B.M. Mining of inferred resources would be by underground mining methods; therefore, mining costs would be high. There is continued interest in the use of small amounts of stockpile and dump materials for high-density cement (Al Bruton, personal commun., 1983).

NAME: Good Hope mine

INDEX MAP NO.: Plate 1, no. 139

LOCATION: SE1/4 sec.21, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 4,200 to 4,450 ft

ACCESS: About 11 mi northwest on the paved Essex Road from Interstate 40, 5.5 mi northwest on graded roads to the 7IL Ranch, then by jeep road 1.5 mi up Barber Canyon, and by foot trail 1 mi to the claim site.

HISTORY: Initial development of both the mine and mill sites is believed to have begun in the late 1920's or 1930's (Howard Blair, personal commun., 1982). In 1974, the Good Hope mine was relocated as the Gold Bug by Charles and James Lowe. In 1981, the claim was declared abandoned by the BLM because no assessment work was filed.

PRODUCTION: Although minor stoping inside the lower adit suggests that some ore was removed, no previous production is reported.

GEOLOGY OF DEPOSIT: Country rock is predominantly Precambrian granite, schist, and gneiss. Overlying the Precambrian basement to the west, east, and north are Tertiary volcanic rocks which form Wild Horse Mesa. The workings are driven along a quartz-filled shear zone striking east and dipping steeply to the north (fig. A-34 and A-35). To the west, the quartz vein disappears beneath a cap of volcanic rocks and is not exposed beyond the western side of the cap. To the east of sample 1, the vein is truncated by a fault (Hazzard, 1954, plate 2) that parallels the East Providence fault. The relationship between these faults is unclear. The vein system crops out for a total strike length of 690 ft, and its maximum vertical exposure is 300 ft.

WORKINGS AND FACILITIES: Workings consist of two adits and three small pits (fig. A-35). The lower adit is 140 ft long, driven to the west along the vein. The second adit, situated about 10 ft above the first, is 30 ft long and connected to the lower adit by a winze about 15 ft inside the portal. At Barber Well, 1 mi to the south, foundations of a mill remain that probably was constructed in support of the mine development (Howard Blair, personal commun., 1982).

SAMPLING: Analyses of 16 chip samples are shown in the table which accompanies figure A-35. Most samples had gold, but only one had silver. Gold values ranged from a trace to 0.256 oz/ton. None of the analyses detected copper or lead.

RESOURCE ESTIMATE: Although the higher gold values were near the west half of the adit, most samples contained some gold. All samples were used to estimate the grade and tonnage of the identified resource block. Grade was calculated by a weighted average, based on sample length. The deposit is estimated to contain a 2.6 ft thick indicated resource block of 4,400 tons with an average grade of 0.070 oz/ton gold and a 2.7 ft

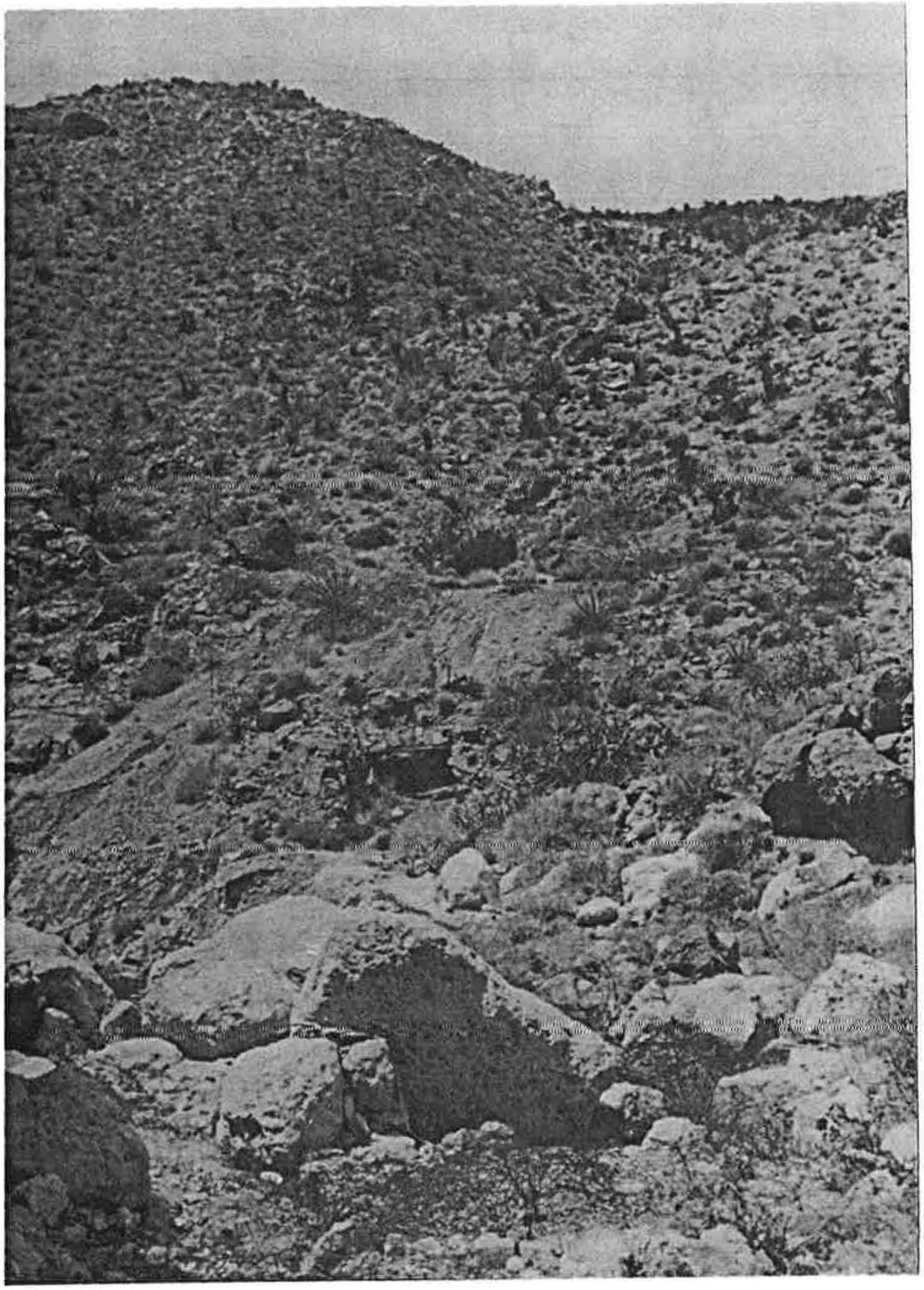


Figure A-34--The Good Hope mine, viewed toward the west, showing two adit portals in the foreground and discontinuous vein outcrops in the background

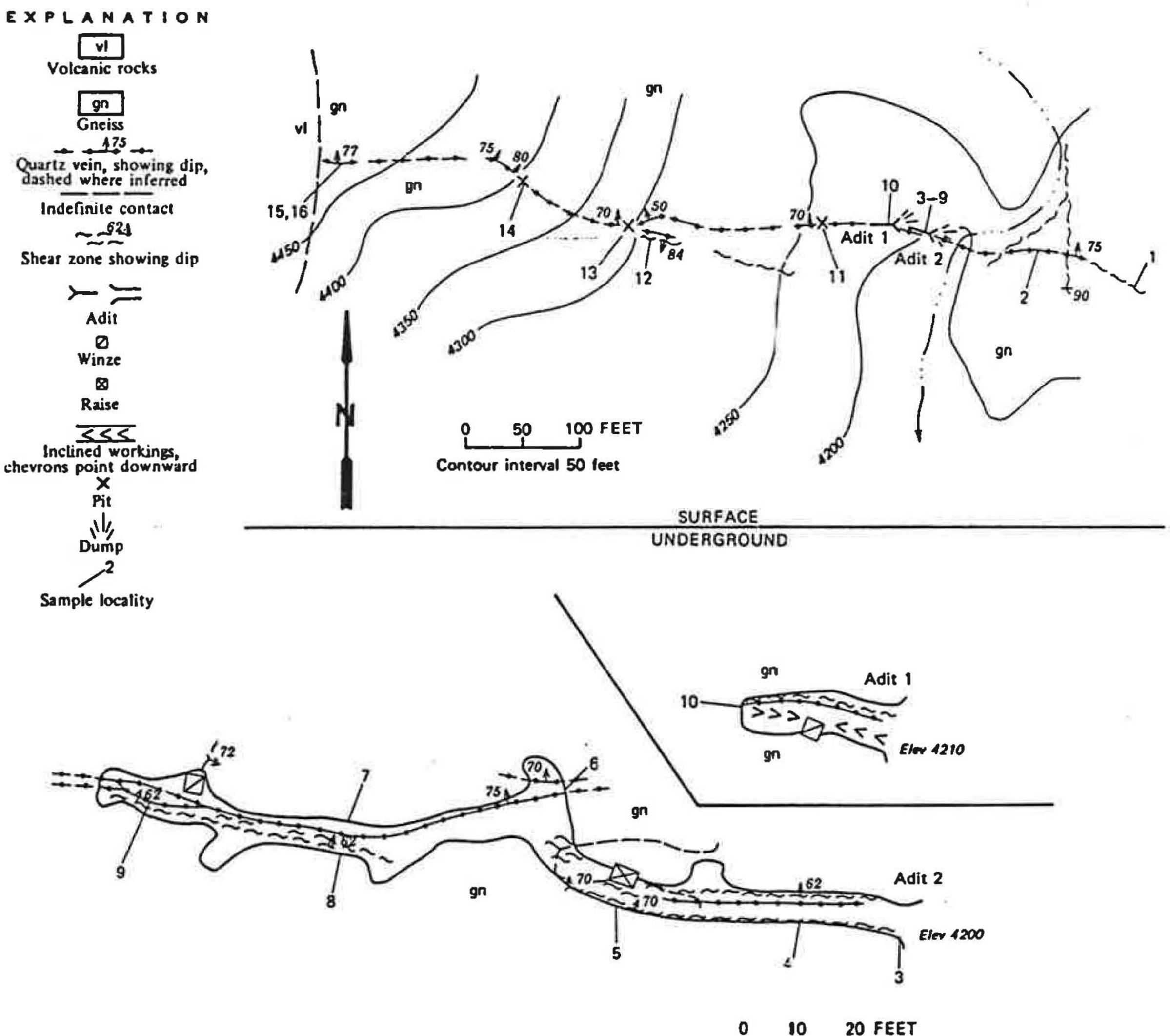


FIGURE A-35—Surface and underground maps, Good Hope mine

Data for samples shown in figure A-35

[Tr, trace; N, none detected]

Sample[1]					
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)
*1	Chip--	3.0	White-gray, translucent, quartz-rich zone with stringers to 6 in. thick---	Tr	0.2
*2	do----	1.0	Fractured, milky quartz and brecciated country rock with limonite filling---	Tr	N
*3	do----	4.2	Brecciated country rock with quartz in fractures------------------------	0.018	N
*4	do----	4.0	Fractured quartz and country rock with 6-in. zone of fault gouge at left rib	.02	N
*5	do----	1.6	Fault gouge with iron-oxide stained country rock------------------------	N	N
*6	do----	2.6	Fractured country rock and fault gouge with quartz filling-----------------	.128	N
*7	do----	1.7	Fault gouge and quartz breccia; iron-oxide stained with some country rock	.08	N
*8	do----	2.6	Iron-oxide stained gouge with quartz and country rock breccia------------	.256	N
*9	do----	2.8	Brecciated country rock with quartz and iron-oxide stringers------------	.144	N
*10	do----	2.0	Brecciated quartz and country rock----	.022	N
*11	do----	.8	Quartz vein with country rock inclusions-------------------------	.10	N
**12	do----	2.3	Quartz vein with foliated country rock	.008	N
**13	do----	3.6	Massive quartz vein------------------	Tr	N
**14	do----	3.2	Quartz-rich, sheared country rock with iron-oxide filling------------------	.01	N

Data for samples shown in figure A-35--Continued

Sample					
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)
**15	Chip--	1.2	Sinuous, massive to comb quartz vein with minor iron-oxide stains---------	N	N
**16	do----	1.0	Clay gouge zone adjacent to sample 15	N	N

---

* Samples used to calculate tonnage and grade of indicated resource.
**Samples used to calculate tonnage and grade of inferred resource.
1/ Additional analysis: all samples analyzed for copper and lead - none detected.

thick inferred resource block of 32,000 tons with an average grade of 0.031 oz/ton gold. The indicated block is projected 30 ft downdip and along strike from sample 1 to 30 ft west of the main adit workface. The inferred block is projected 150 ft west under the volcanic cap and 150 ft downdip. There was no eastward projection due to faulting. A tonnage factor of 12 ft^3/ton is used.

CONCLUSIONS: The deposit is estimated to contain an identified subeconomic resource of 36,000 tons at an average grade of 0.036 oz/ton gold. At a market price of $400/oz gold, the unit value is $14.40/ton. Tonnage and grade calculations outlined in the previous section are indicators at best, but the pervasive gold and strength of the structure suggest that this property may have additional vein-type resources at depth. No evidence was found that the deposit continues to the east or west.

NAME: Silver King mine (Perseverance mine)

OWNER: Blair Brothers (Howard, Jerry, and Scott)

INDEX MAP NO.: Plate 1, no. 144

LOCATION: SW1/4SW1/4 sec. 28, E1/2E1/2 sec. 32, and W1/2W1/2 sec. 33, T. 11 N., R. 14 E., S.B.M.

ELEVATION: 3,960 to 4,200 ft

ACCESS: About 11 mi northwest on the paved Essex Road from Interstate 40, then 6.5 mi north on graded and four-wheel-drive roads to the mine site.

HISTORY: Records from Mineral Survey (No. 2537) indicate the Perseverance Quartz mine was located by Diedrich Bahten and others in November 1886, although Burchard (1885, p. 142) noted the Perseverance mine had an 80-ft-deep shaft in 1884. Adjacent claims included the Pitman, the Buster, and the Perseverance millsite. The Mineral Survey was conducted in February 1887, but the property was never patented. De Groot (1888, p. 532; 1890, p. 532) and Crossman (1890, p. 238) noted activity on the Perseverance mine in the late 1880's and production from the Kerr (five-stamp) mill. No further activity is documented until Yale in 1908 (p. 221) noted probable production from the Silver King mine. A small amount of activity from 1918-1920 was noted by Tucker (1920) and in USBM statistical files; however, the property is reported idle in 1921 (Tucker, 1921, p. 364-365). With the exception of ownership changes, no further activity is noted by later writers (Tucker and Sampson, 1930, p. 281 and 284; 1931, p. 354 and 357; Eric, 1948, p. 314; Wright and others, 1953, p. 83-84 tables; Goodwin, 1957, p. 660). Unruh and Faris (1980, p. 535) reported activity on the property by Brownstone Mining Co. in 1979. The Blair Brothers, the current claimants, located the Silver King and several adjacent claims in 1979-80. George Reiberg of B & B Mining Co. located the Sylvia Nos. 1-9 in 1981, but the claims were not known to be active in 1984. Edward Tomany, Production Exploration Resources, located the Silver King Nos. 2-4 in 1982 and had an option on the Blair Brothers property in the same year. Recent activity includes backhoe trenching and sampling.

PRODUCTION: USBM statistical files show production of 1 ton in 1918 and 19 tons in 1920. The 20 tons contained 6.98 oz gold, 1,489 oz silver, 11 lbs copper, and 232 lbs lead. Tucker (1920, p. 3) reported the estimated total historic production, presumably in the 1880's, as $250,000.

GEOLOGY OF DEPOSIT: The deposit occurs along the north-trending, east-dipping, reverse East Providence fault, between Precambrian granite gneiss on the east and Paleozoic carbonate rocks on the west (fig. A-36 and A-37). The fault contact is exposed for more than 4,000 ft on the property, a 1,200-ft-long segment of the fault southward from near shaft 2 is mineralized. Carbonate rocks along the fault are commonly brecciated, iron-oxide stained, and healed with calcite or quartz. The granite gneiss is intensely weathered and occurs as gouge along the

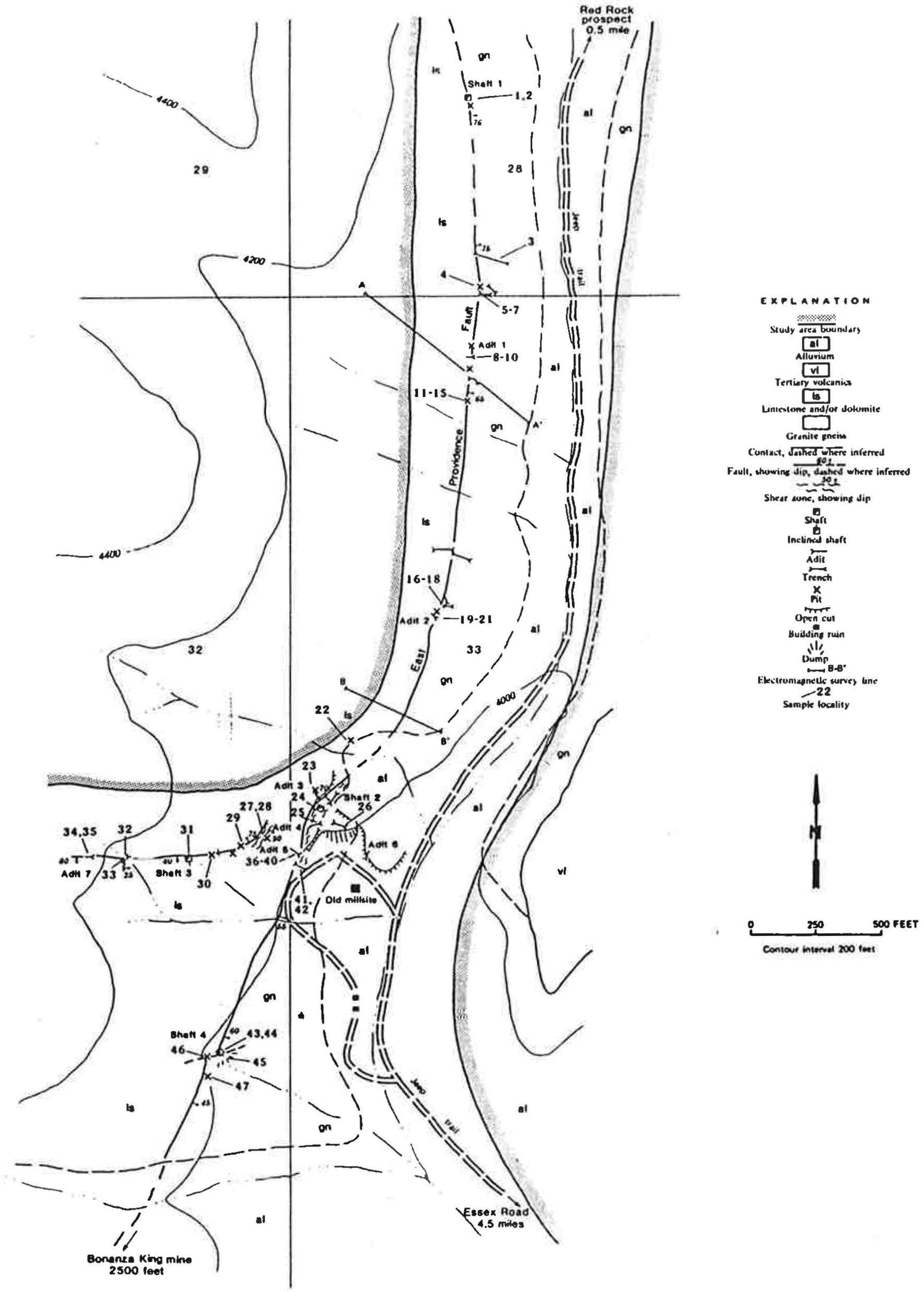


FIGURE A-36--Surface map, Silver King mine

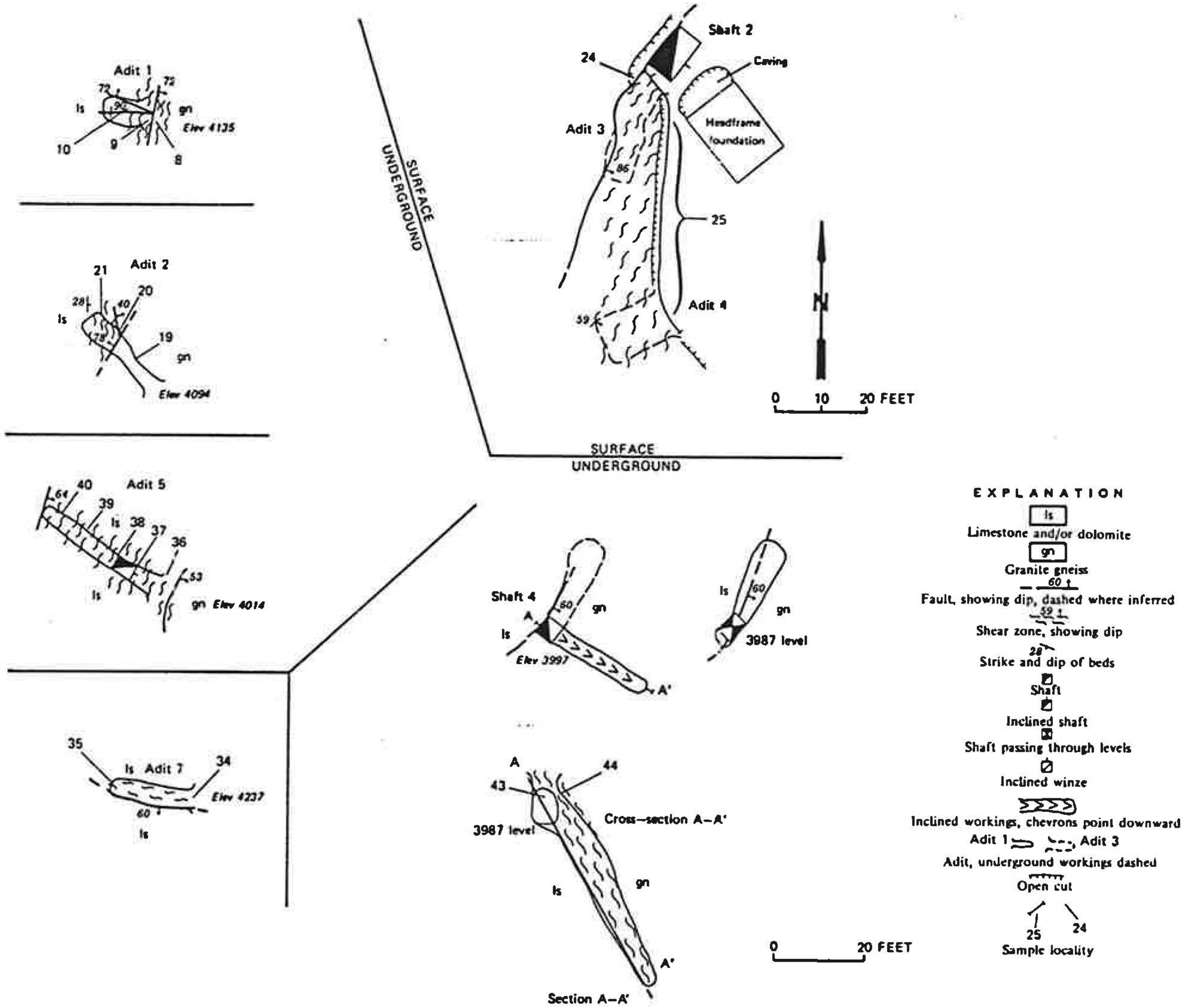


FIGURE A-37–Underground maps, adits 1,2,5, and 7, underground map and section, shaft 4, and surface map, shaft 2 and adits 3 and 4, Silver King mine

Data for samples shown in figures A-36 and A-37

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
1	Chip	2.6	Sheared and brecciated limestone	N	N	--	--	--
2	do	2.4	Fault gouge with bleached limestone and granite gneiss	N	N	--	--	--
3	Random chip	NA	Through 125 ft of brecciated and altered granite gneiss	N	N	--	--	--
4	Chip	4.5	Iron-oxide healed limestone breccia in footwall	N	N	--	--	--
5	do	6.0	Bleached and iron-oxide stained gouge with granite gneiss and minor limestone fragments	N	N	--	--	--
6	do	6.0	do	N	N	--	--	--
7	do	6.0	do	N	N	--	--	--
8	do	2.0	Tan to white clay gouge with minor iron-oxide staining	N	0.2	--	--	--
9	do	7.2	Iron-oxide stained, altered, brecciated limestone	N	.1	--	--	--
10	do	2.0	do	N	N	--	--	--

Data for samples shown in figures A-36 and A-37--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
11	Chip	4.5	Pale-green gouge and altered intrusive rock.	N	N	0.0014	--	--
12	do	4.5	do	N	N	.0009	--	--
13	do	4.0	Friable, buff-to-orange gouge	N	N	.0010	--	--
14	do	6.0	Fractured to sheared, altered intrusive rock.	N	N	.0008	--	--
15	do	6.0	do	N	N	.0005	--	--
16	do	1.7	Fault zone	N	0.1	--	--	--
17	do	2.9	Sheared, dark-green to red-brown metamorphic rock	N	.1	--	--	--
18	do	7.2	Buff gouge in granite gneiss	N	N	--	--	--
19	do	6.5	Friable, gray gouge, and sheared granite gneiss	N	N	--	--	--
20	do	1.6	Soft, banded gray and reddish-orange gouge zone on crosscutting fault	N	N	--	--	--
21	do	6.0	Slightly iron-oxide stained, brecciated limestone in footwall	N	N	--	--	--
22	Random chip	NA	Iron-oxide cemented limestone breccia; possible bedding plane fault	Tr	.1	--	--	--

Data for samples shown in figures A-36 and A-37--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
23	Chip--	4.2	Silica-healed limestone breccia zone with moderate iron-oxide stains------------------	0.01	1.4	--	--	--
24	do----	3.0	Sheared and brecciated, calcite and iron-oxide healed, gray limestone breccia zone---	.01	2.6	--	--	--
25	Random chip--	NA	Through 30 ft of fault gouge along limestone contact with granite gneiss-----------------	N	1.6	--	--	--
26	Grab--	NA	Representative sample of material from dump--	.01	.8	N	0.01	0.02
27	Chip--	5.0	Silica healed, iron-oxide stained and replaced limestone breccia------------------	Tr	1.1	0.0014	.021	.034
28	do----	5.0	do---	Tr	.6	.0012	.012	.020
29	Random chip--	NA	Intersecting faults with intense, red iron-oxide alteration and healing---------------	.01	.2	.0010	.023	.047
30	Chip--	2.5	Brecciated limestone-------------------------	.01	7.7	.0050	.135	.36
31	do----	2.5	do---	N	3.7	.0081	.195	.261
32	do----	2.8	Calcite and iron-oxide healed limestone breccia--------------------------------------	N	.4	.0011	.014	.016

Data for samples shown in figures A-36 and A-37--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
33	Chip--	1.5	Calcite and iron-oxide healed breccia and gouge zone along probable bedding plane fault--------------------------------------	N	1.3	0.0020	0.023	0.049
34	do----	4.0	Moderately iron-oxide stained, brecciated limestone------------------------------------	N	N	.0013	.022	.010
35	do----	1.9	Fractured-to-slightly brecciated, iron-oxide stained and healed, dark gray limestone-----	0.02	N	.0010	.0057	.0073
36	do----	7.0	Fault gouge and limestone breccia-----------	Tr	1.4	.0020	.030	.018
37	do----	7.0	do--	N	.9	.0076	.071	.023
38	do----	7.0	do--	N	1.5	.0098	.117	.051
39	do----	7.0	do--	N	1.2	.0027	.087	.035
40	do----	6.5	do--	N	6.1	.0060	.266	.074
41	do----	6.0	Fault gouge with minor chlorite and brecciated limestone------------------------------------	N	.2	.0009	.0021	.0069
42	do----	6.0	do--	N	N	.0010	N	.0051
43	do----	3.2	Very hard, dark gray, calcite healed limestone breccia--------------------------------------	.04	3.0	.0047	.068	.089

Data for samples shown in figures A-36 and A-37--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
44	Chip--	2.8	Pale-green to orange gouge zone above main breccia zone----------------------------------	Tr	0.7	0.0077	0.042	0.090
45	Grab--	NA	Massive to brecciated carbonate rock contains quartz veinlets and coarse-grained calcite, hematite, barite, galena, cerrusite, anglesite, willemite, argentite, and malachite------------------------------------	Tr	1.0	.0027	.043	.138
46	Chip--	3.0	Gouge zone with brecciated limestone---------	0.01	2.2	.0036	.066	.259
47	do----	4.0	do---	N	.1	.0010	.0025	.0036

fault. Two VLF electromagnetic surveys across the fault (fig. A-38, A-A' and B-B') showed good phase and quadrature responses for the fault contact, but no indication of large conducting bodies. A 750-ft-long splinter fault in carbonate rock, which intersects the main structure near shaft 2, is also mineralized.

Silver and lead are the main metallic elements, occurring primarily as lenses and pods of argentiferous galena, cerussite, argentite, cerargyrite, and silver chlorides and bromides. Malachite is observed on outcrops. Microprobe examination of one sample also revealed traces of anglesite and willemite (Zn_2SiO_4). The deposit is very similar chemically and structurally to the Bonanza King deposit. The higher grade values appear to be spatially related to intersecting faults (cross-breaks) such as in the vicinity of shafts 2 and 4. Mineralized bodies range from less than 1 ft to greater than 20 or 30 ft thick. The largest body is thought to occur for 400 ft along the main fault zone at shaft 2 which has most of the underground development, and presumably production.

WORKINGS AND FACILITIES: Four shafts, 7 adits, 11 trenches, and 14 pits are developed on the property (figs. A-36 and A-37). Shaft 2, the main working, is reported (Tucker, 1920) to be 162 ft deep with 500 ft of drift on the 74-ft level, 550 ft of drift on the 110-ft level, and 300 ft of drift on the 162-ft level with minimal stoping. Shaft 2 is open but too dangerous to enter. Some of this underground work may have developed the southwest fault splinter. The original Mineral Survey noted two houses, an assay office, and a mill. Adits 1-5 and 7 range from 10 to 30 ft in length and are shown on figure A-37; adit 6 is in alluvium and may have been a powder bunker. Shafts 1 and 3 are shallow prospects, and shaft 4 is 50 ft deep with a 25-ft drift and a small open cut at the collar (fig. A-37). Three wooden cabins are located near the south end of the property.

SAMPLING: Forty-one chip, 4 random chip, and 2 grab samples were taken from workings and outcrops on the Silver King property. Sample locations are shown on figures A-36 and A-37, and the analyses are listed in the accompanying table. Of 14 samples which contained gold, 6 contained a trace and 8 contained from 0.01 to 0.04 oz/ton gold. Of 27 samples which contained silver, 9 ranged from 0.1 to 0.5 oz/ton, 4 ranged from 0.6 to 0.9 oz/ton, and 14 ranged from 1.0 to 7.7 oz/ton and averaged 2.6 oz/ton silver. No copper, lead, or zinc values exceeded 1 percent.

No gold and no significant silver values were detected in 21 samples from the north half of the property. Significant precious- and base-metal values are associated with larger structures and structure intersects exposed in the south half of the property. Silver values along the southwest-trending splinter fault decline to the west, away from the East Providence fault.

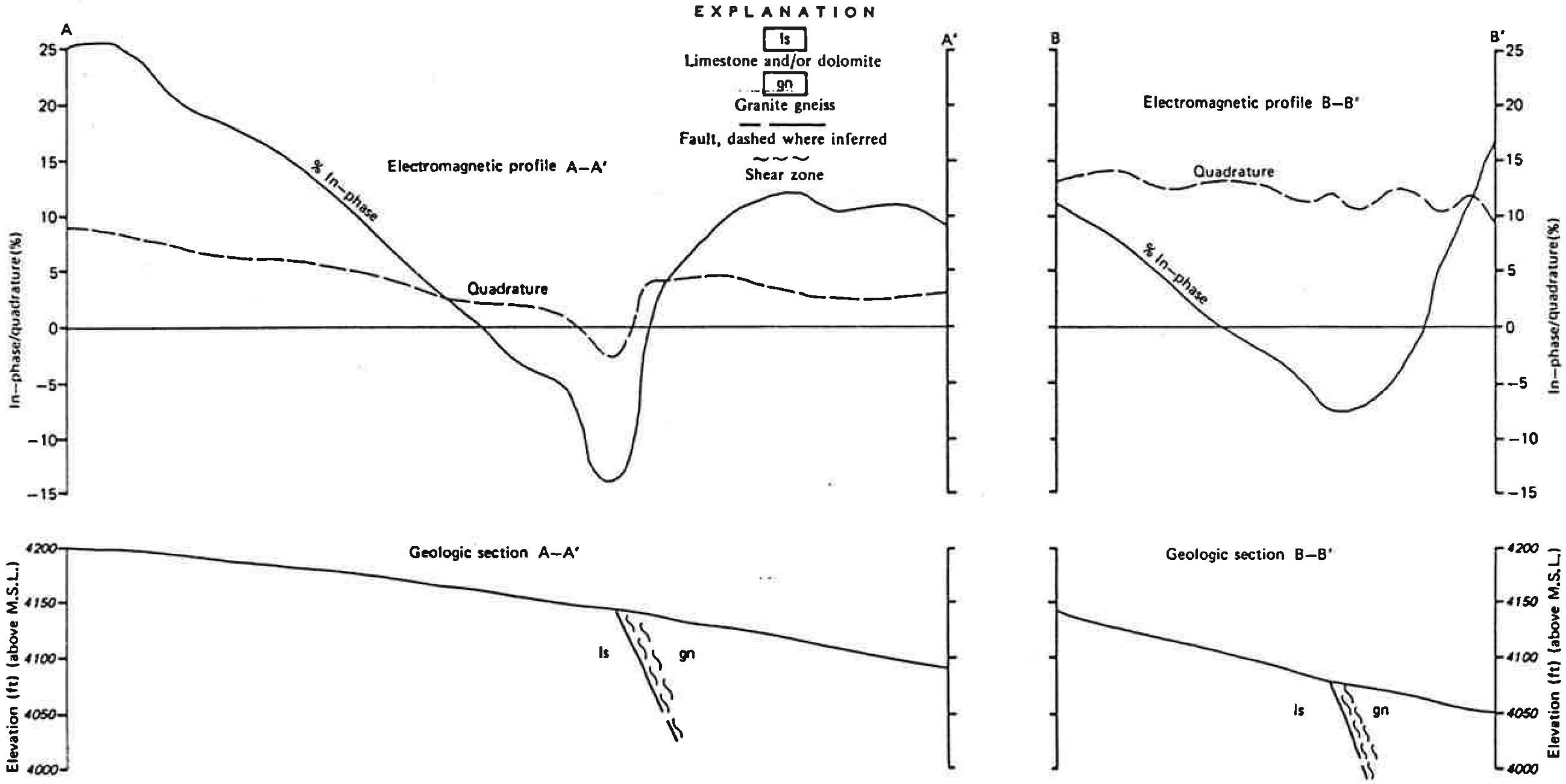


FIGURE A-38—VLF electromagnetic surveys and geologic sections, A-A' and B-B', Silver King mine

RESOURCE ESTIMATE: Tucker (1920) noted that grades from the early production ranged from 10 to 30 oz/ton silver and about 0.4 oz/ton gold and cited as reserves a 300-ton dump which contained 10 oz/ton silver. However, one grab sample (no. 26) from the main dump contained only 0.010 oz/ton gold and 0.8 oz/ton silver.

Sample analyses and the documented 1918-1920 production have an average silver to gold ratio of about 240:1. Based on Tucker's (1920) estimate of total production ($250,000) and precious-metal values of $1/oz silver and $20/oz gold, it is estimated that the deposit produced at least 7,500 tons of ore at an average grade of approximately 30 oz/ton silver and 0.1 oz/ton gold.

CONCLUSIONS: Significant silver and gold values and anomalous lead, copper, and zinc are associated with fault controlled fissures and breccia zones. Deposits containing 1 to 10 oz/ton silver, 0.01 to 0.1 oz/ton gold, and byproduct lead, copper, and zinc remain at the center of the property. Resources of 5,000 to 10,000 tons at a grade of 10 to 30 oz/ton silver might be expected in the mineralized zone.

NAME: Bonanza King mine

OWNER: Ownership and interest in the overall property varies by claim and has evolved as the mine was prospected:

Bonanza King mine (patented) - owned by Bill and James Molnar and leased to Weaco Resources, Ltd. and Bolero Mines, Inc. through Charles Keegel and Denys Poyner.

Bonanza King North Extension (patented) - owned by Douglas and William Van Gessel; leases or options unknown.

Rattler mine (patented) - owned by H. Howard Goodman and others (Trust); leases or options unknown.

Providence 1-7 - claimed by Charles Keegel and Denys Poyner; leased to Weaco Resources, Ltd. and Bolero Mines, Inc.

Ord 1-43 - claimed by Weaco Resources, Ltd. and Bolero Resources, Inc.

INDEX MAP NO.: Plate 1, no. 146

LOCATION: E1/2 sec. 3, T. 10 N., R. 14 E.; SE1/4 sec.32, T. 11 N., R. 14 E., S.B.M. Main shaft located approximately 1/4 mi east of the study area.

ELEVATION: 4,000 to 4,400 ft.

ACCESS: About 11 mi northwest on the paved Essex Road from Interstate 40, then 6.5 mi north on graded and four-wheel-drive roads to the mine site.

HISTORY: The Bonanza King mine was discovered by George Gorman and P. Dwyer in 1880, and there followed a run of prospectors, claimants, and companies over the next two years (Mining and Scientific Press, April 1, 1882, p. 214; Vredenburgh and others, 1981, p. 89-91) and the establishment of the town of Providence. The property ultimately came under the ownership of the Bonanza King Consolidated Mining Co. and was producing high-grade ore by 1883. The Bonanza King, Bonanza King North Extension, and Rattler mines were surveyed for mineral patent in August 1883 (Mineral Surveys 2130-2132, respectively) and patented in August 1884 (patent nos. 701839-701841, respectively) according to BLM Master Title Plats. In 1885, 100 miners were employed to produce 25 tons/d; $35,000 to $50,000/month was produced (Mining and Scientific Press, March 21, 1885, p. 189 and 196). Development reached a depth of 800 ft. The ten-stamp Crow Town mill, situated 1.5 mi east of the mine and just north of the 7IL Ranch, dry crushed and amalgamated by the "Boss Process," pulp in continuous current through a series of pans containing mercury (De Groot, 1890, p. 532). The mill burned in July 1885 (Mining and Scientific Press, August 15, 1885, p. 120), and mining was temporarily abandoned. Subsequent development and production of the mine was sporadic and short lived. Minor production was reported until 1887 with milling at the five-stamp Kerr Mine mill.

In 1906 the Trojan Mining Co. reactivated the mine and constructed a new ten-stamp mill (Vredenburgh and others, 1981, p. 92); only minor production was reported until closure of the mine in September 1907 (Yale, 1908, p. 221; 1909, p. 347). An examination and favorable report was released about 1907, and Holbrook and McGuire of San Francisco were reported owners in 1915-1916 (Cloudman and others, 1919, p. 827). Mining activity was reported from about 1915 to 1920. Vredenburgh and others (1981, p. 92-93) reported that the mill was revamped in 1919 and treating 40 tons/d of old dump by flotation. Hall, Rawitser and Co. of Massachusetts were reported as owners in 1920 (Tucker, 1921, p. 361). Little is known in detail after 1920 although minor production, probably experimental, is recorded in USBM statistical files for 1924, 1925, 1929-30, 1936, and 1960. The timber in the main shaft burned in the 1960's, effectively preventing access.

The dates that current ownership of the patented properties was assumed is not known. Messrs. Keegel and Poyner located the Providence claims around the patented group in July 1979, and the Ord claims were located by Ord Silver Mines, Ltd. for Weaco Resources, Ltd. and Bolero Mines, Inc. of Vancouver, British Columbia, Canada in August 1982. A series of detailed investigations by lessees have been conducted on the property since early 1978. Work included detailed geologic mapping and analyses, surface and underground sampling, thousands of feet of rotary and diamond drilling in several episodes (fig. A-39), underground mapping and retimbering, and development of a 300- to 400-ft decline for the purpose of further drilling.

PRODUCTION: Total production from the Bonanza King mine is unknown. The greatest volume and value of production was from the period 1883-87; previous to accurate record keeping. De Groot (1890) noted that during the intermittent active periods from 1883-87, the mine produced up to $60,000/month, and the ore averaged $100/ton (average silver price $0.98 - 1.11/oz). Total value of production during this time reported as $1.8 million (Mining World, Feb. 6, 1906, p. 225-226). Recorded production after 1900 (USBM statistical files) is shown on table A-3.

GEOLOGY OF DEPOSIT: The ore formed as replacement bodies along "cross-breaks" or tension fractures in brecciated carbonate rocks between the north-northeast-trending, steeply east-dipping East Providence fault on the east and a parallel-trending, steeply west-dipping or vertical fault on the west shown on figure A-40 as the Western Boundary fault (Landwehr, 1932, p. 136-138). Precambrian metaigneous rocks (Hazzard, 1954) lie east of the East Providence fault and are juxtaposed by reverse movement against the carbonate rocks on the west. Landwehr (1932) noted that the ore bodies were largest nearer the surface and concluded that, due to the closer proximity of the bounding faults near the surface, fracturing was more intense and permeability higher in the upper parts of the deposit. This is somewhat confirmed by the distance between the bounding faults as shown on the level maps (figs. A-41 to A-46); estimated to be 90 to 100 ft on level 1 and 400 ft on level 5. Tucker (1921, p. 360-361) noted that the proven ore zone was 400 ft wide by 1,000 ft long and that most ore was deposited along three well defined,

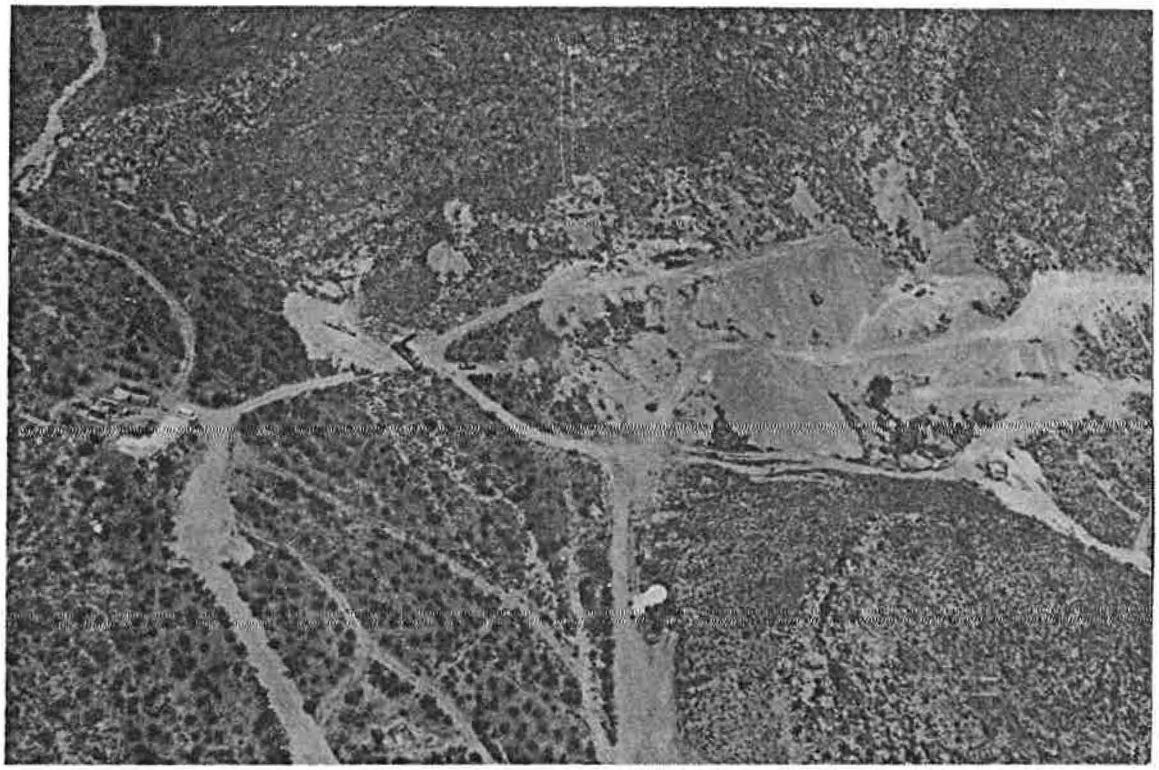


Figure A-39--Oblique northwest vein of the Bonanza King mine. Note drill rig near center of protopraph

TABLE A-3.--Production from the Bonanza King mine recorded in USBM statistical files

(--, not recorded)

Year	Crude ore (tons)	Concentrates (tons)	Gold recovered (oz)	Silver recorded (oz)	Copper recovered (lb)	Lead recovered (lb)	Zinc recovered (lb)
1901	--	--	1.64	13,332	--	--	--
1907	50	--	5.32	2,424	--	--	--
1915	44	--	4.02	9,821	354	6,638	--
1916	47	--	--	1,313	--	3,449	--
1917	21	--	--	3,434	--	2,035	--
1918	2,039	45	2.00	13,797	--	--	--
1919	1,600	32	3.00	7,767	--	4,800	--
1920	1,330	38	4.01	7,323	--	5,271	--
1924	25	--	.84	1,424	158	2,148	--
1925	4	--	3.42	466	256	892	--
1929	56	--	6.98	12,834	--	11,242	--
1930	30	--	18.34	3,444	--	3,984	--
1936	56	--	1.00	1,382	--	--	--
1960	--	41	6	3,511	145	28,816	2,312
Total	5,302	156	56.57	82,272	913	69,275	2,312

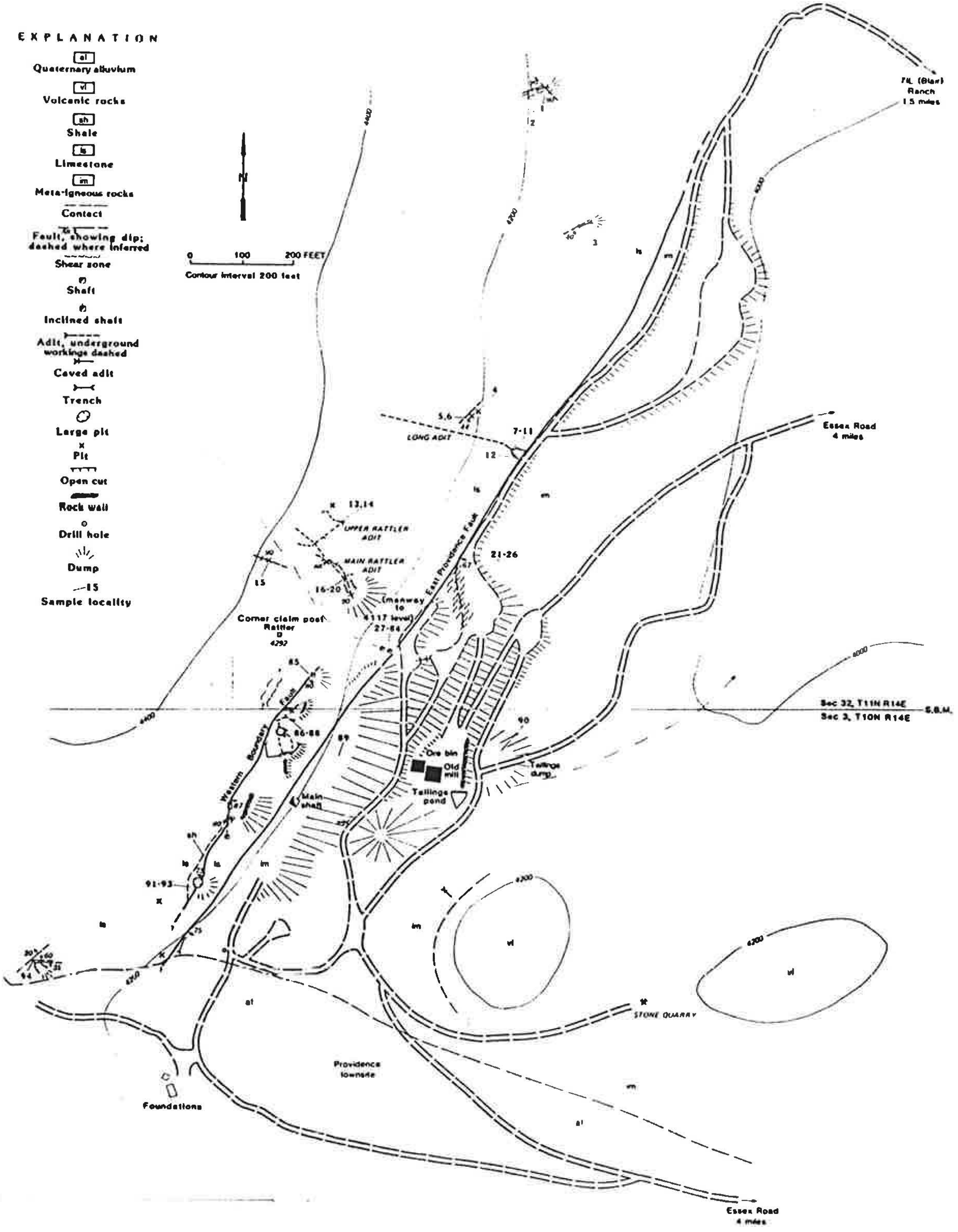


FIGURE A-40—Surface map, Bonanza King mine

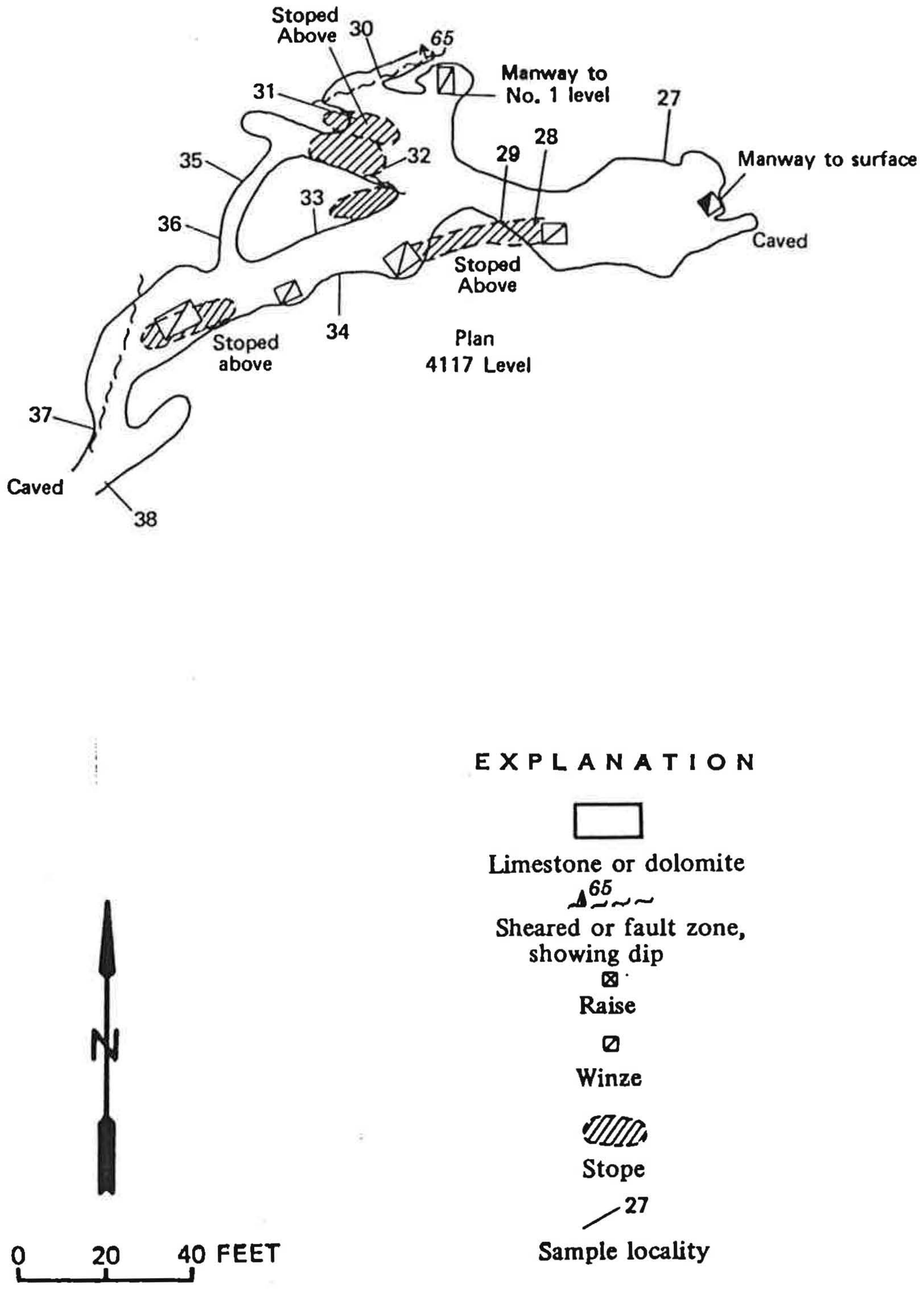


FIGURE A-41—Underground map, 4117 level, Bonanza King mine

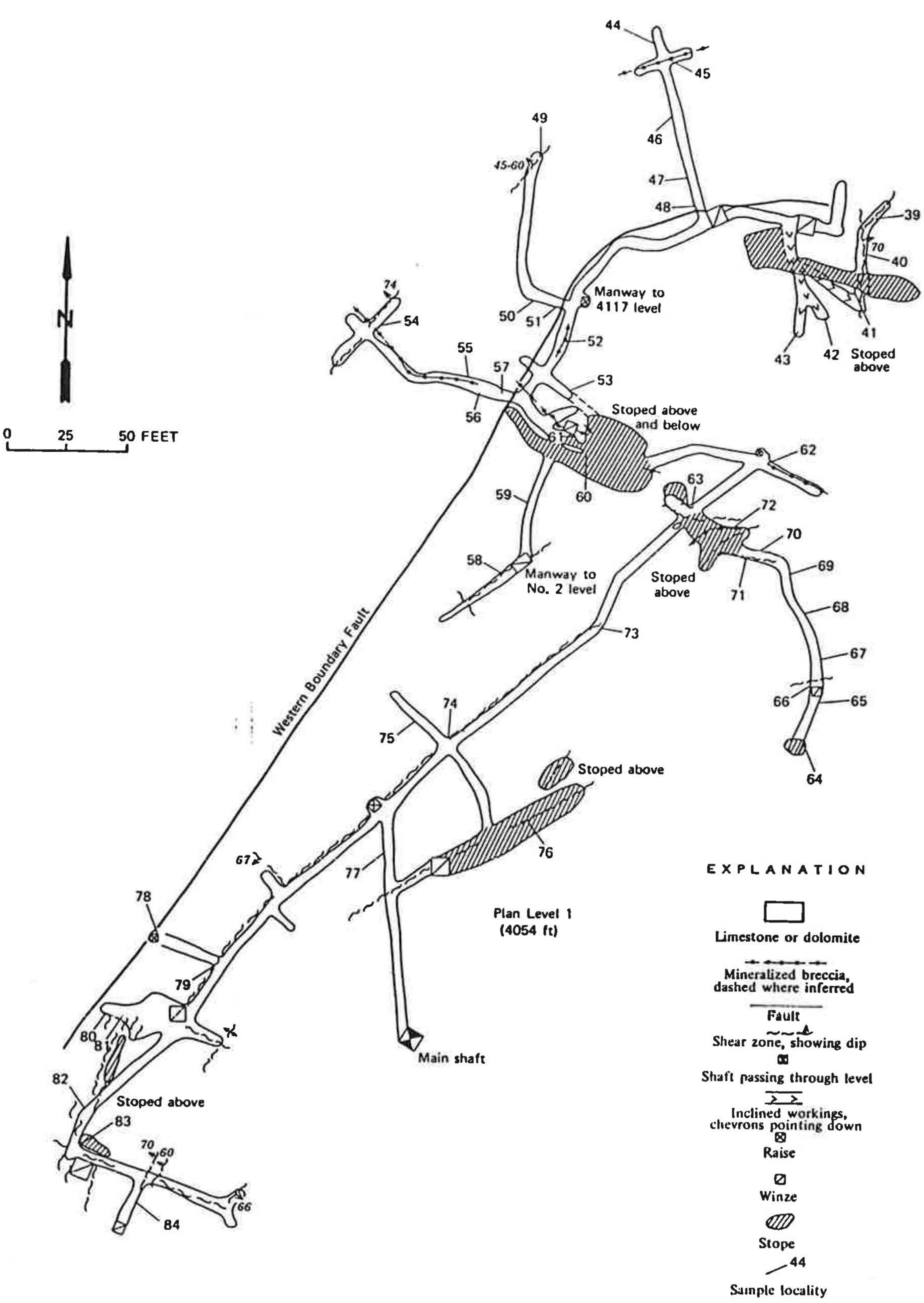


FIGURE A-42—Underground map, level 1 (4,054 ft), Bonanza King mine

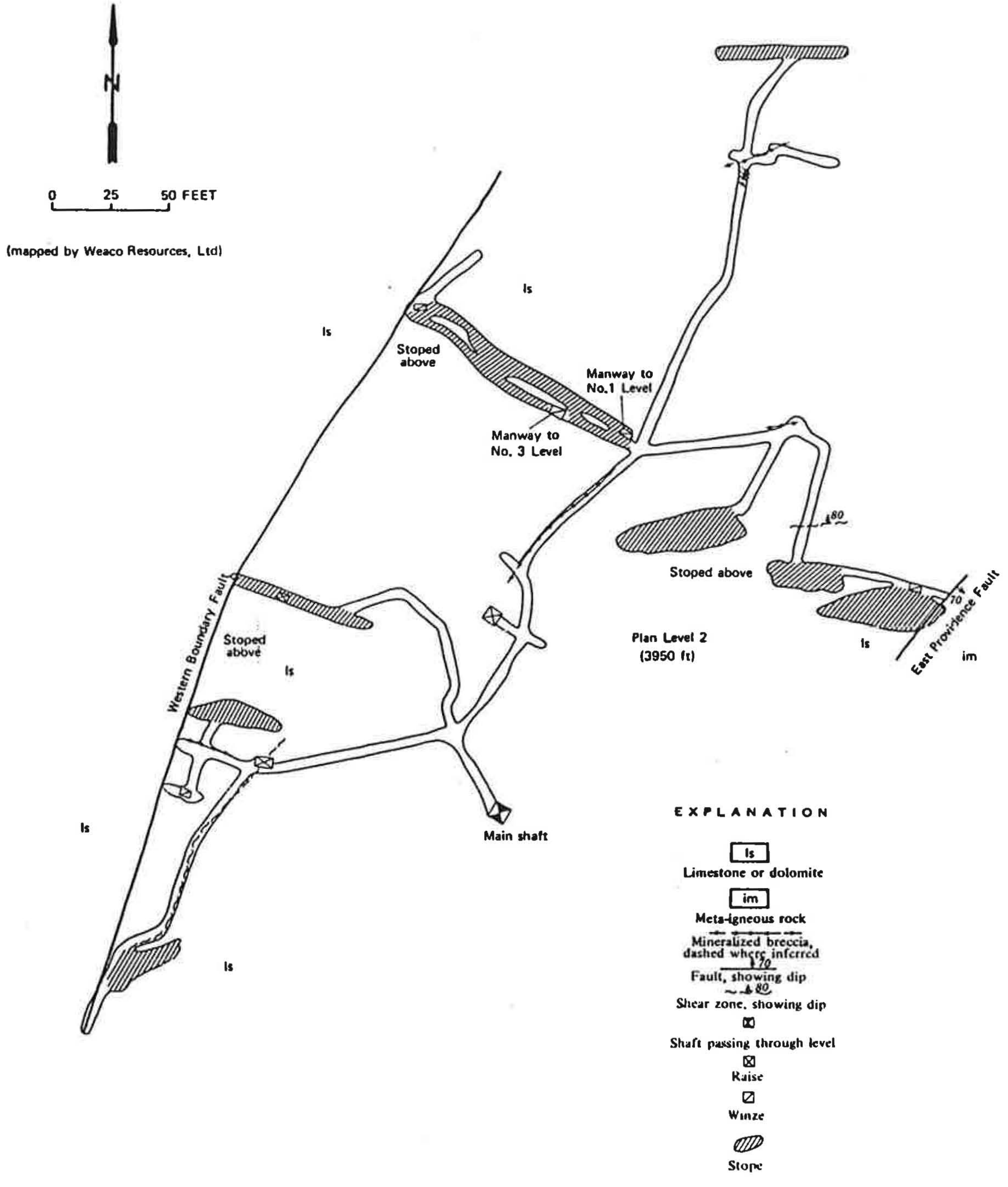


FIGURE A-43—Underground map, level 2 (3,950 ft), Bonanza King mine

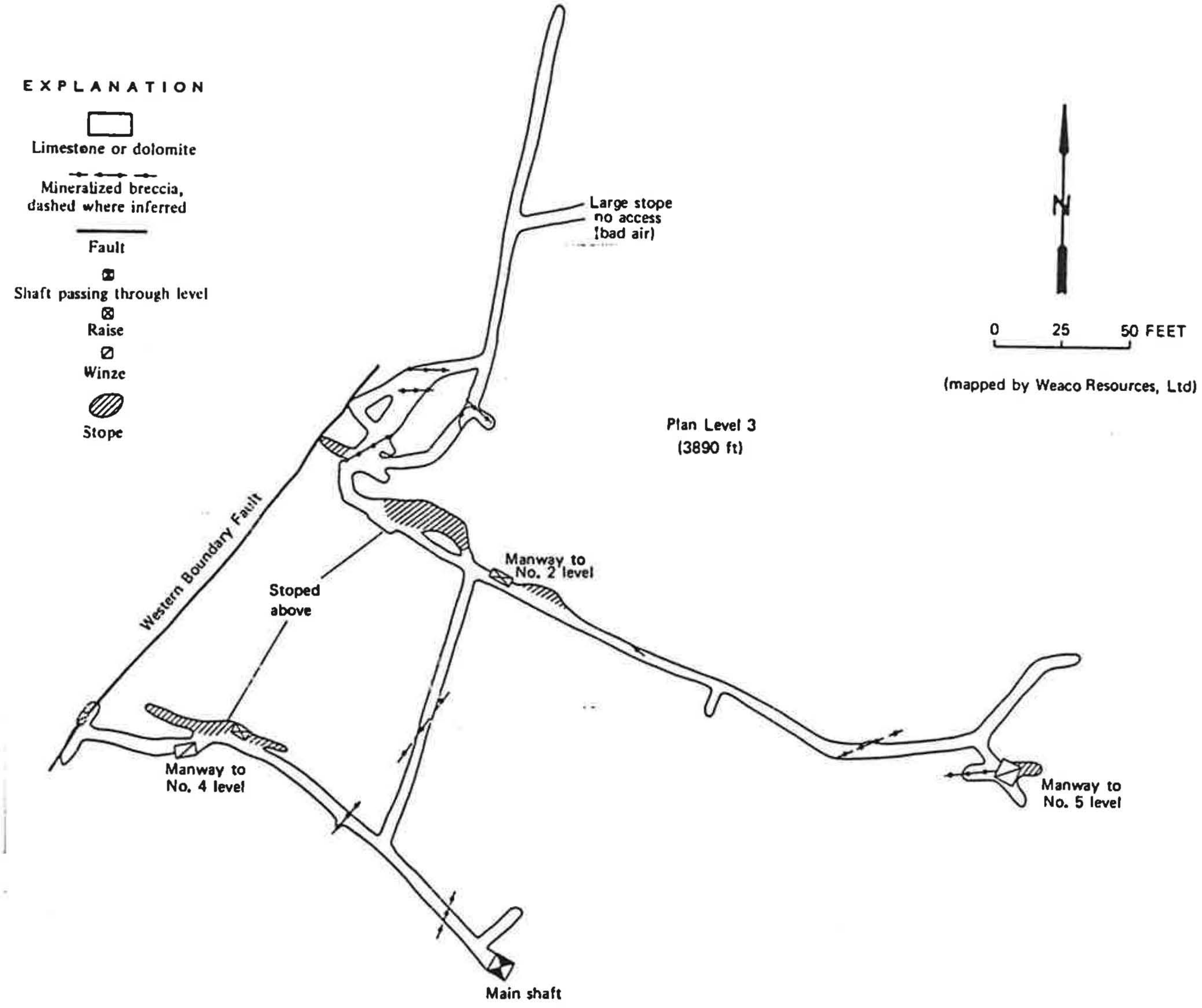


FIGURE A-44—Underground map, level 3 (3,890 ft), Bonanza King mine

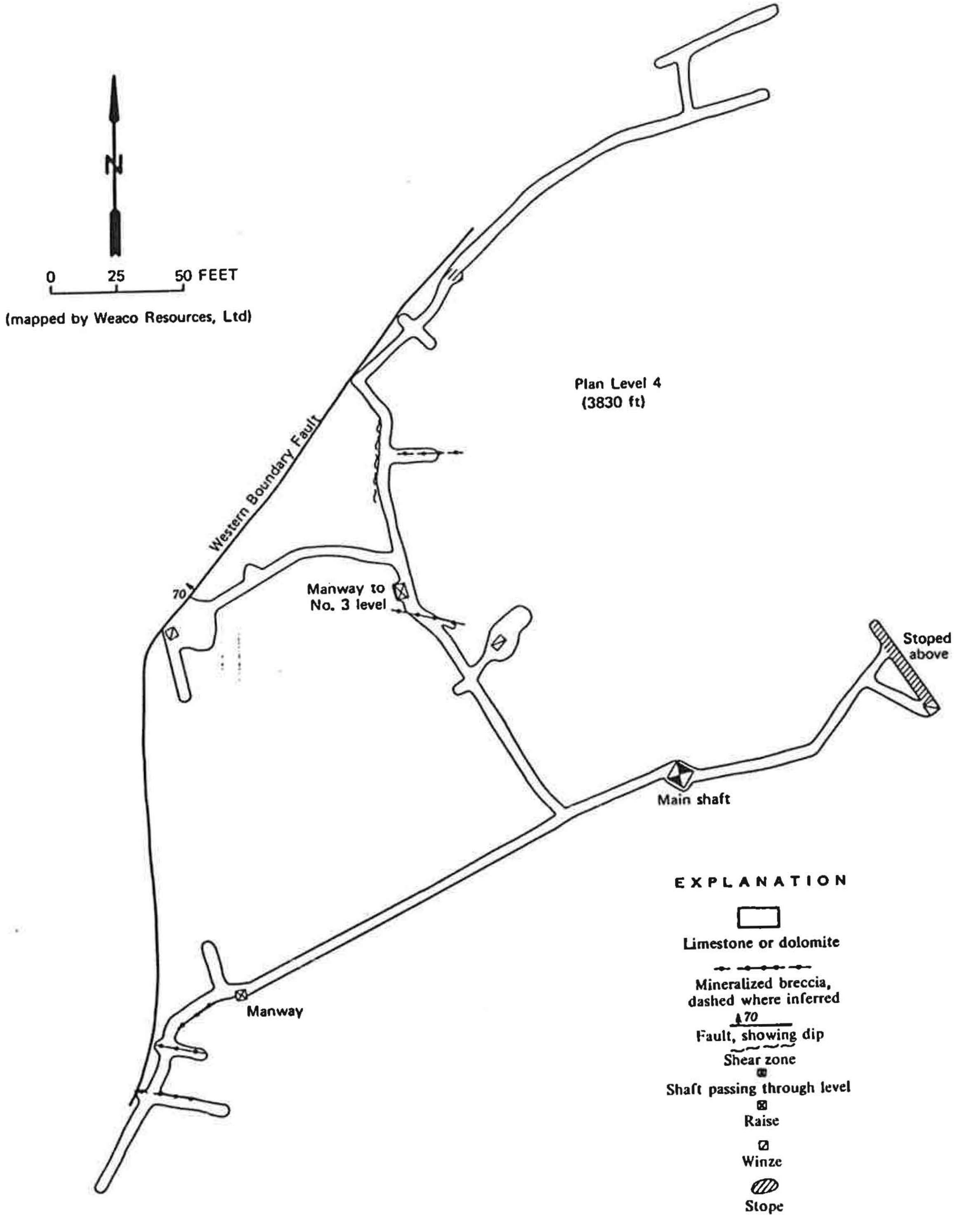


FIGURE A-45—Underground map, level 4 (3,830 ft), Bonanza King mine

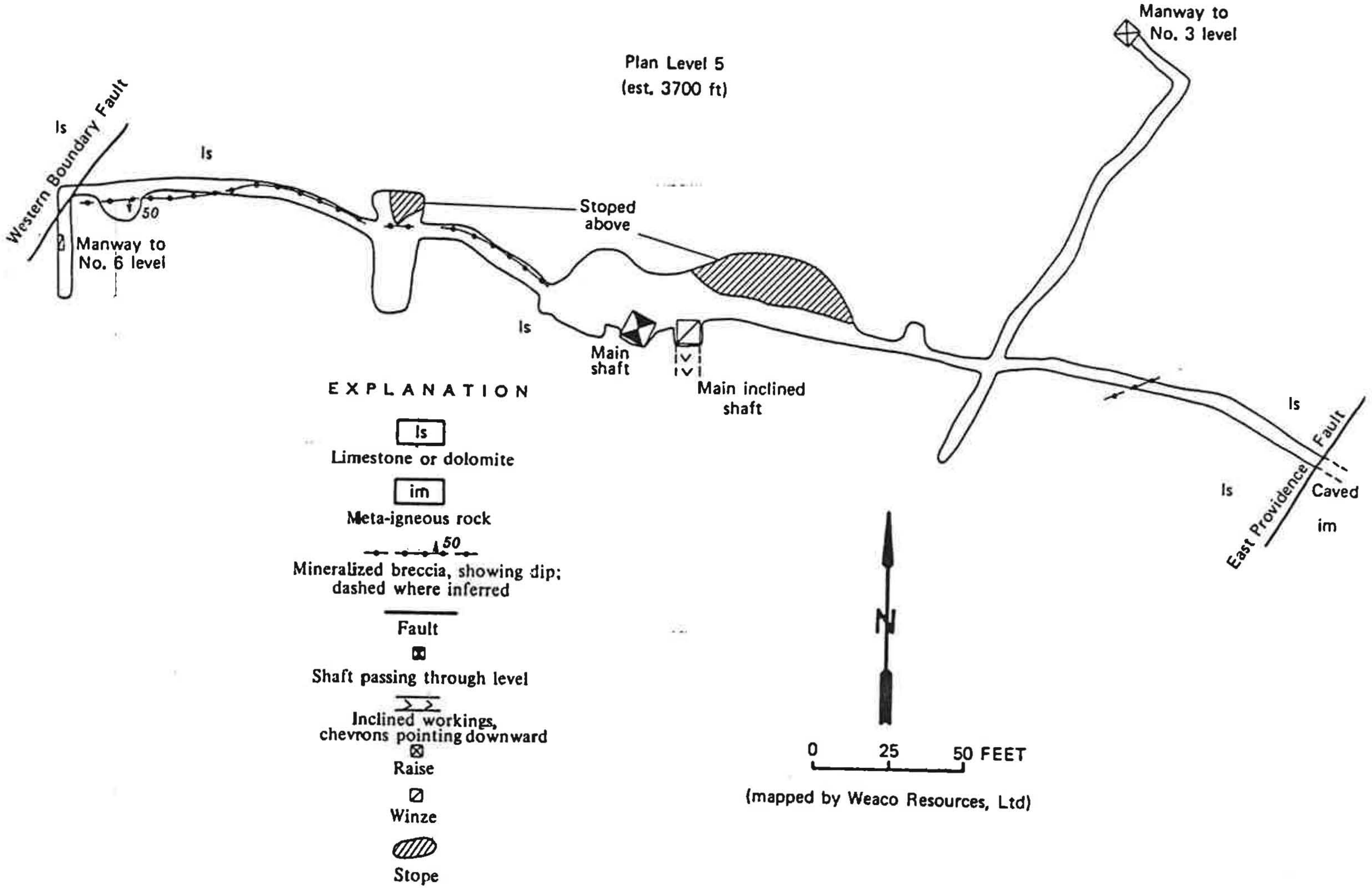


FIGURE A-46—Underground map, level 5 (est. 3,700 ft), Bonanza King mine parallel fissures named Ray, Hogan, and Peat. These were interpreted by all writers (due to the lack of underground structure maps) except Landwehr (1932) as being parallel to the bounding faults; Landwehr (1932) correctly described them as cross-breaks. These zones range from 4 to 20 ft thick and generally span the distance between the bounding faults. Smaller deposits also occur along the main faults.

The mineralized bodies commonly occur as mineral replacements in iron oxide- and calcite-healed breccia zones. Tucker (1924, p. 198) described the composition as predominantly chloro-bromides of silver with small amounts of galena. The chloro-bromides probably occur as cerargyrite and bromyrite. Argentite, pyrite, sphalerite, and galena, as well as smithsonite, cerussite, and malachite (carbonates of zinc, lead, and copper, respectively), were identified in petrographic samples. Due to the predominance of oxidized ore minerals, the mineralized zones are generally identified by a mosaic of red iron-oxide fillings between breccia fragments.

WORKINGS AND FACILITIES: The main working is a network of drifts and crosscuts on eight main levels connected by stopes, raises, and intermediate levels and serviced by an 800-ft-deep main shaft (fig. A-40). Access in 1983 was by a manway from the 4,117 ft intermediate level shown on figure A-40 as sample sites 27-84. Total underground development in the main working was reported by Wright and others (1953, p. 72-73 tables) to be more than 20,000 ft. The intermediate (4,117 ft) level and level 1 (figs. A-41 and A-42) were mapped and sampled by the USBM, while levels 2-5 (figs. A-43 to A-46) were mapped and sampled by Weaco Resources, Ltd. workers. More than 7,400 ft of drifts and crosscuts are mapped. Levels 6-8 are not accessable due to debris-filled manways and bad air. The three unmapped levels together with all of the interconnecting stopes, raises, and winzes could exceed 12,000 ft. The upper levels of the main working are connected to the surface by a network of raises and stopes shown on figure A-40 as eight shafts north and west of the main shaft.

Other workings (fig. A-40) on the property include seven pits, six trenches, seven adits (three of which are caved), an inclined shaft into the Main Rattler Adit, and one tunnel. The three largest adits (figs. A-47 and A-49) (Long, Upper Rattler, and Main Rattler) total about 560 ft of drifts and crosscuts. One additional pit, not shown on the surface map, is located in a canyon approximately 0.3 mi east of the main shaft. Other developments on the property include a dense network of access and drill roads, an old ore bin, mill foundations, a tailings pond and pile, the main dump, and a cone-shaped reject or stockpile. Weaco Resources, Ltd. reported in 1984 that it developed a 300- to 400-ft-long decline from the vicinity of sample site 21-26 for the purpose of exploratory drilling.

SAMPLING: Seventy-three chip, 18 random chip, 3 grab, and 1 select sample were taken by the USBM from workings and outcrops on the Bonanza King property. Sample locations are shown on figures A-40 to A-42 and A-47 to A-49, and the analyses are listed in the accompanying table. Of

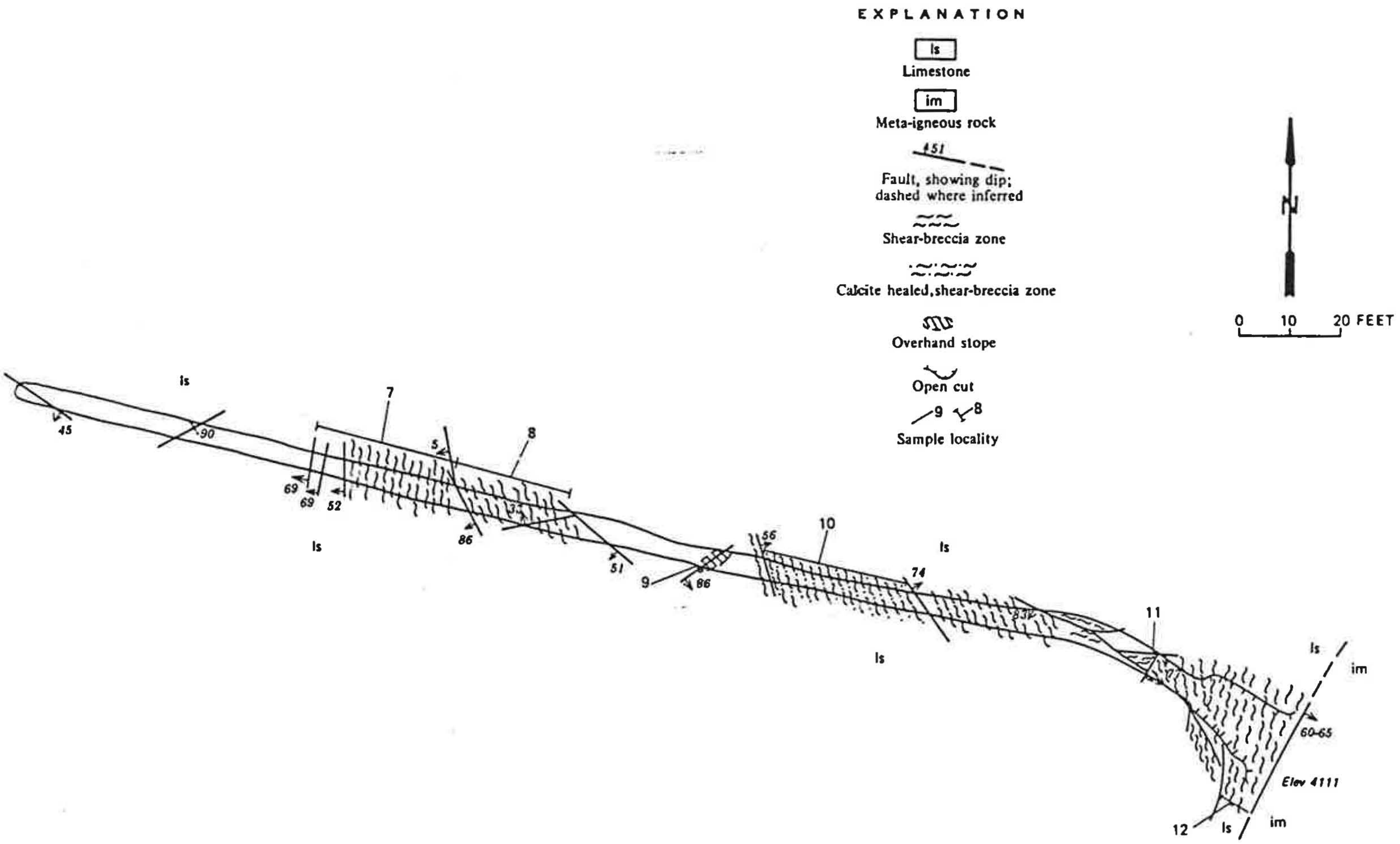


FIGURE A-47—Underground map, Long Adit, Bonanza King mine

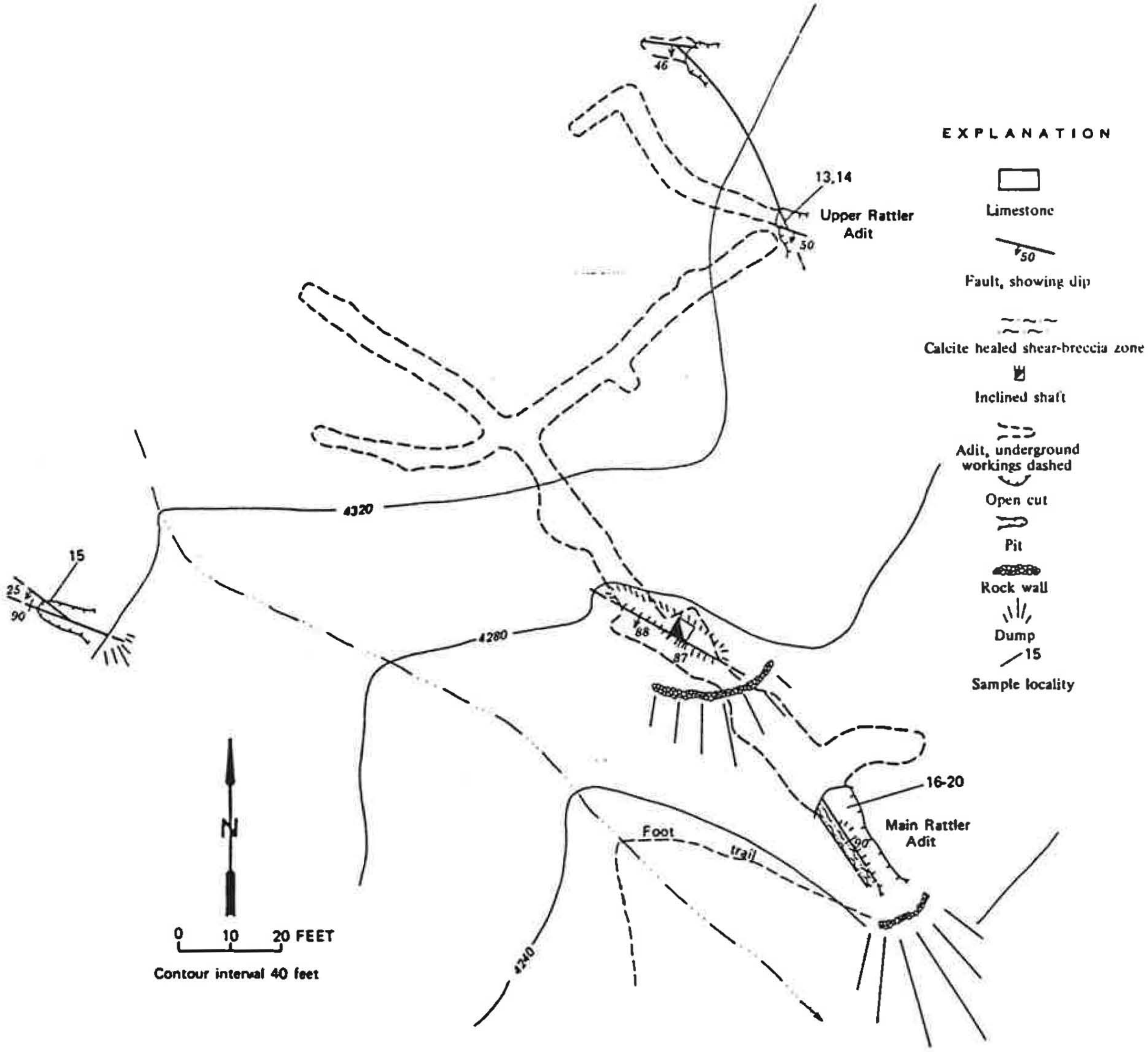


FIGURE A-48—Surface map, upper and Main Rattler Adits, Bonanza King mine

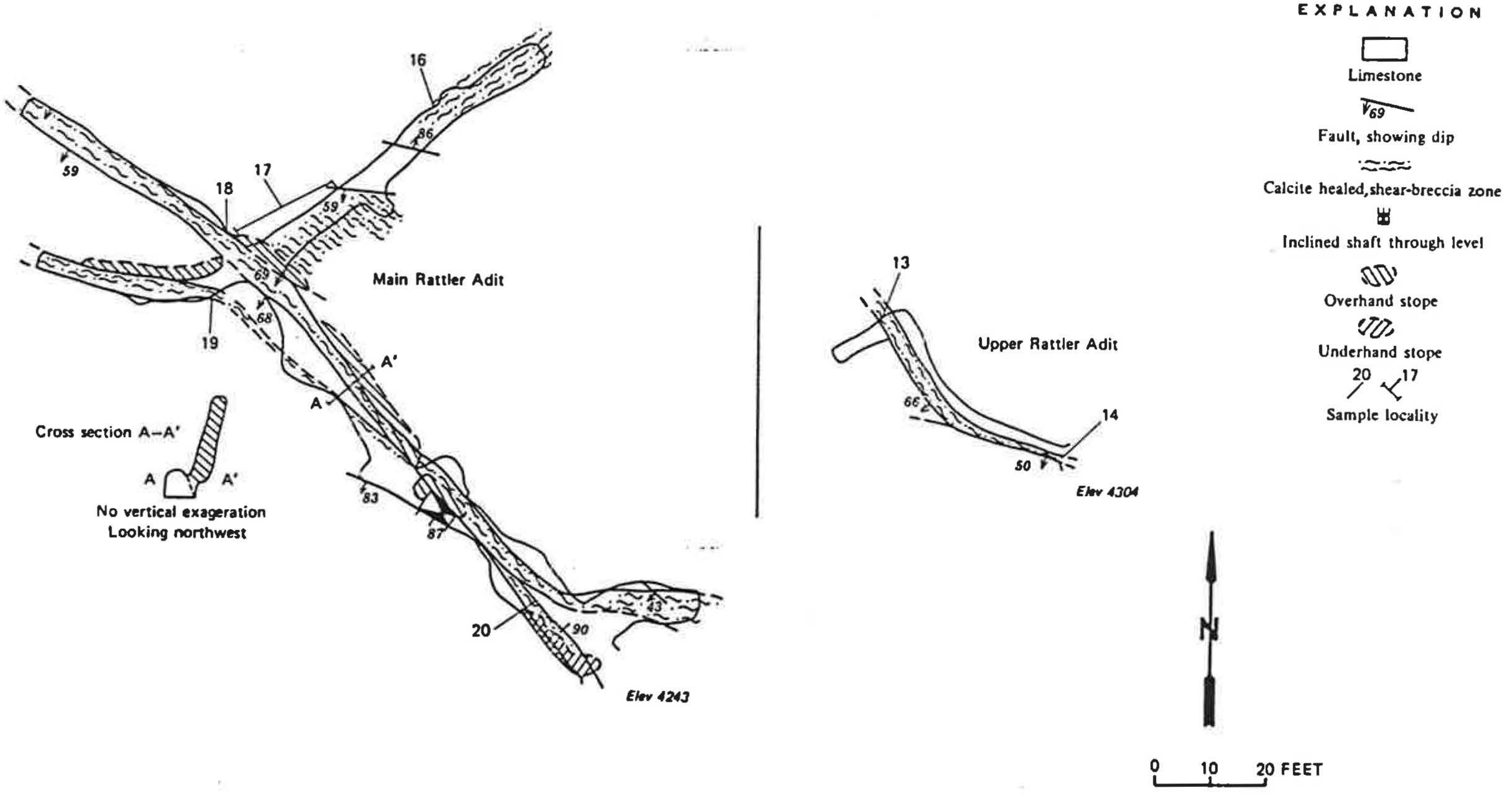


FIGURE A-49—Underground maps, Upper and Main Rattler Adits, Bonanza King mine

Data for samples shown in figures A-40 - A-42, and A-47 - A-49

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
1	Chip	1.8	Shear and breccia zone in gray limestone; calcite healed	N	N	0.0016	0.024	0.015
2	do	4.0	do	N	N	.0039	.026	.0082
3	Random chip	NA	Many intersecting shears and faults in zone of brecciated limestone with calcite and iron oxides	N	N	.0026	.0089	.0044
4	Select	NA	Shear-breccia zone with clay, iron oxides, and calcite stringers and healing	Tr	8.6	.013	.207	.55
5	Chip	2.1	Buff to orange, bleached, iron-oxide stained gouge zone with breccia fragments of limestone and gneiss	N	1.2	.0048	.093	.154
6	do	1.6	Iron-oxide and calcite healed limestone breccia	N	.4	.0017	.037	.075
7	Random chip	NA	Through a 28-ft-thick section of fractured to brecciated, massive to friable, buff to gray, calcite-healed limestone; minor sulfides present	N	N	.0110	.0230	.0096
8	do	NA	Brecciated limestone with shale	N	N	.0160	.0340	.0130

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
9	Chip--	2.5	Stope into limestone with abundant calcite--	N	0.14	0.0080	0.0250	0.0150
10	Random chip--	NA	Through 33 ft of open to healed, black, limestone breccia-------------------------	N	.13	.0060	.0260	.0190
11	Chip--	2.5	Brecciated limestone healed by crystalline calcite and reddish iron-oxide------------	N	.04	.0085	.0570	.0310
12	do----	6.0	Through East Providence fault; fractured-to-brecciated limestone and gneiss zones bound a 4-ft-thick gouge zone------------------	N	.2	.0011	.010	.0073
13	do----	1.5	Poorly defined, calcite-healed, iron-oxide-stained breccia zone----------------------	N	.3	.0013	.0065	.0069
14	do----	2.3	Distinct breccia zone in limestone---------	N	N	.0011	.023	.021
15	do----	1.8	Breccia zone above intersection of two faults	Tr	N	.0015	.033	.016
16	do----	2.0	Calcite-healed, iron-oxide-stained breccia near shear zone---------------------------	N	N	.0012	.012	.023
17	Random chip--	NA	Through 18 ft of calcite-healed, iron-oxide stained breccia zone----------------------	N	.4	.0017	.040	.092
18	Chip--	2.8	Calcite-healed, red, iron-oxide stained, brecciated limestone; main structure-------	N	.9	.0070	.141	.33

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
19	Chip	1.6	Sheared to brecciated zone	N	4.6	0.0088	0.223	0.43
20	do	4.4	Intensely brecciated, gray limestone	N	.4	.011	.183	.61
21	do	6.0	Fault contact; buff to orange iron-oxide stained limestone with buff to green, contorted gneiss; gouge is friable with some gneiss fragments	N	N	.0013	.025	.013
22	do	6.0	do	N	N	.0012	.038	.021
23	do	6.0	do	N	N	.0008	.0025	.0061
24	do	6.0	do	N	N	.0007	N	.0057
25	do	6.0	do	N	N	.0005	N	.0049
26	Random chip	NA	Through 65 ft of sheared, green gneiss and some gouge zones	Tr	N	.0015	.033	.016
27	Chip	2.1	Brecciated, healed limestone in footwall of fault or fracture zone; minor limonite	Tr	2.9	.020	.063	.133
28	do	.8	Gray dolomite with estimated 10% galena. Limestone mottled gray and brown with small spots to 0.25 in. on surfaces; partly brecciated	0.01	27.7	.013	1.31	.44

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
29	Chip--	5.0	Coarse breccia zone in hanging wall of shear zone; moderate limonite, minor secondary copper minerals; minor galena----	N	7.3	0.019	0.188	0.180
30	do----	.5	Gray dolomite breccia with white carbonate cement. Weathered with limonite and copper and manganese secondary minerals. Estimated 30% sulfides------------------------------	1.28	775.5	--	4.1	.56
31	do----	4.2	Intensely weathered, argillized, sheared dolomite------------------------------------	Tr	3.5	.011	.051	.34
32	do----	2.1	Shear zone comprised of coarse grained carbonate, brecciated dolomite, and minor galena and other sulfides-----------	.01	13.6	.028	.35	.55
33	do----	1.4	Gray fractured dolomite--------------------	N	.7	.0024	.017	.024
34	do----	4.9	Sheared, argillized, weathered dolomite; limonitic-----------------------------------	N	.7	.0035	.020	.074
35	do----	1.8	Intensely weathered, argillized, sheared dolomite------------------------------------	N	.3	.0015	.012	.016
36	do----	1.0	Fractured gray dolomite--------------------	N	N	.0009	.011	.0080
37	do----	.9	Sheared, weathered, argillized dolomite-----	N	5.2	.029	.064	.32

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
38	Chip--	1.0	Limonite- and hematite-veined, gray dolomite	N	0.5	0.0083	0.024	0.055
39	do----	4.0	Sheared, brecciated dolomite----------------	N	.1	.0016	.0085	.014
40	do----	23.0	Brecciated gray dolomite with a few small shears across drift; small shear along drift not in sample-----------------------	N	.2	.0018	.010	.024
41	do----	2.4	Brown, limonitic vuggy breccia of dolomite healed by white carbonate. Contains galena, chalcopyrite(?), argentite(?), sphalerite(?), tetrahedrite(?), chrysocolla, azurite, and malachite----------------------------------	0.02	22.6	.117	.98	2.84
42	do----	3.7	Brecciated dolomite in shear zone at face of short drift----------------------------	Tr	N	.0009	.0060	.0065
43	do----	3.2	Brecciated dolomite in face of short drift--	N	.5	.0014	.019	.019
44	Random chip--	NA	Through 21 ft of gray, fractured dolomite with a few minor shears; locally intensely fractured----------------------------------	N	.1	.0007	.0066	.0078
45	Chip--	.8	Sheared, brecciated, gray dolomite at foot of stope-----------------------------------	N	N	.0007	.020	.018

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
46	Random chip--	NA	Through 35 ft of gray, fractured dolomite with a few shears to about 1 in. subparallel to major shear to east--------------------	N	0.1	0.0008	0.012	0.0071
47	Chip--	7.0	Alternating mylonite and dolomite layers----	0.01	.1	.0017	.0085	.011
48	do----	10.5	do---	N	N	.0021	.0041	.0061
49	do----	.9	Brecciated dolomite along shear; earthy red limonite along zone, which is semi-friable------------------------------------	N	.3	.0014	.021	.024
50	do----	7.0	Sheared, argillized, gouge-rich zone with some competent dolomite layers; few vugs and acicular translucent mineral in zone---	N	.6	.0037	.045	.185
51	do----	7.0	Alternating gouge, dolomite, and brecciated dolomite layers---------------------------	N	.2	.0013	.020	.022
52	do----	3.5	Brecciated dolomite healed by white carbonate. Breccia medium to coarse, coated by brown minerals; some dendritic patches-----------	.01	2.8	.0074	.060	.135
53	do----	.33	Sheared, brecciated, gray dolomite----------	.05	2.2	.0088	.074	.206
54	do----	1.0	Brecciated zone, 0.5 to 1.0 ft thick, in dolomite. Earthy red clay filling; some dendritic stains--------------------------	N	1.7	.0046	.207	.55

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
55	Chip--	0.8	Dark gray dolomite breccia with minor limonite stains----------------------------	N	40.0	0.015	0.276	0.99
56	do----	6.0	Gray to brown fractured, brecciated, healed dolomite at shear intersection------	N	1.0	.0024	.105	.162
57	do----	5.0	Dark gray dolomite, intensely fractured and sheared. Vugs have transparent needles of a manganese(?) mineral-----------------	N	.2	.0022	.013	.036
58	do----	1.0	Brecciated zone 0.7 to 2.0 ft thick in dolomite. Earthy and crystalline red, brown, orange, and yellow coatings on brecciated fragments; some dendritic stains-------------------------------------	0.01	23.1	.041	.035	.40
59	Random chip--	NA	Through 39 ft of fractured gray dolomite----	N	N	.0017	.021	.027
60	Chip--	.7	Gray dolomite breccia with an estimated 20% to 30% sulfides. Has dendritic patches and limonitic, copper carbonate stains-----	.02	12.8	.014	1.19	.37
61	do----	.8	Brecciated, sheared siliceous, dolomitic zone. Average fragments are about 0.25 in. across-------------------------------------	N	1.0	.021	4.6	1.12

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
62	Chip--	1.2	Brecciated dolomite; average clast size less than 0.5 in.------------------------------	N	2.6	0.012	0.108	0.251
63	do----	.2	Brecciated gray dolomite with galena and other sulfides----------------------------	Tr	1.9	.0023	.050	.063
64	do----	7.0	White and gray brecciated dolomite----------	N	1.2	.0080	.057	.075
65	Random chip--	NA	Through 15 ft of white dolomite with minor gray dolomite stringers------------------	N	N	.0012	.0066	.0082
66	Chip--	.8	White and gray dolomite--------------------	N	1.0	.0046	.034	.053
67	Random chip--	NA	Through 13 ft of gray fractured dolomite; estimated 25% irregular white carbonate veinlets to 1 in., averaging 0.25 in.------	N	.2	.0011	.0091	.0054
68	do----	NA	Through 26 ft of dark gray fractured dolomite; estimated 15% small white carbonate veinlets------------------------	N	.2	.0013	.0097	.012
69	do----	NA	Through 15 ft of black or dark gray limestone with small white carbonate veinlets; limonite along fractures---------------------------	N	.5	.0017	.014	.022
70	do----	NA	Through 13 ft of fractured gray dolomite with less than an estimated 10% white carbonate veinlets------------------------	Tr	.4	.0014	.019	.043

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
71	Chip--	0.3	Brecciated gray dolomite with galena and other sulfides------------------------------	0.03	56.6	0.035	2.56	0.48
72	do----	6.0	Brecciated dolomite cemented by quartz (?); some galena and secondary copper minerals--	.01	22.3	.049	.70	1.27
73	Random chip--	NA	Through 20 ft of brecciated, sheared dolomite; some gouge and limonite----------	N	.5	.0014	.024	.032
74	Chip--	.9	Sheared, brecciated dolomite with some limonite in mylonite----------------------	Tr	.5	.0044	.021	.055
75	Random chip--	NA	Through 41 ft of gray dolomite-------------	.01	N	.0008	.0097	.011
76	Chip--	4.0	Fractured gray dolomite; may represent rock mined from stope-------------------------	.23	7.0	.026	.107	.92
77	do----	1.5	Gray fractured dolomite; minor limonite-----	N	.3	.0009	.0070	.0066
78	do----	2.9	Intensely sheared, weathered, argillized dolomite----------------------------------	.01	3.7	.0072	.030	.019
79	Grab--	NA	Intensely sheared, weathered, gray dolomite.	Tr	.6	.0019	.025	.056
80	Chip--	6.5	Gray, shaly, gouge-rich dolomite with an estimated 40% carbonate veinlets to 1 in. Limonitic with a white efflorescence-------	N	N	.0016	.0035	.0040

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
No.	Type	Length (ft)	Description					
81	Chip--	3.0	Intensely sheared, argillized, weathered dolomite; white efflorescence-------------	Tr	0.4	0.0026	0.0078	0.0078
82	do----	3.5	Shear zone with mylonitic gouge and brecciated dolomite----------------------	0.04	N	.0016	.0041	.0030
83	do----	2.3	Fractured gray dolomite with hematite and limonite----------------------------------	Tr	N	.0016	.015	.022
84	Random chip--	NA	Through 12 ft of fractured gray dolomite----	N	.4	.0012	.015	.0092
85	Chip--	1.6	Calcite healed, limestone breccia zone with iron oxides------------------------------	Tr	4.2	.066	.219	2.40
86	do----	5.0	Fractured to brecciated, slightly iron-oxide stained gray limestone moderately healed with calcite------------------------------	.20	6.7	.019	.105	.135
87	do----	5.0	Continuation of sample 86; intensely iron-oxide stained breccia, slightly healed with calcite------------------------------------	N	3.2	.023	.111	.260
88	do----	5.0	Breccia zone with variable fragment sizes and variably healed with calcite-----------	Tr	5.4	.023	.261	.42

Data for samples shown in figures A-40 - A-42, and A-47 - A-49--Continued

Sample								
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)	Zinc (%)
89	Grab--	NA	Brecciated to massive gray limestone from dump; some calcite, galena, and pyrite observed-------------------------------------	0.010	2.2	0.01	0.30	0.92
90	do----	NA	Through 5 ft of tan, silt-sized material from tailings pile------------------------	.0002	.56	.0140	.16	.42
91	Chip--	5.0	Contorted, sheared, limey siltstone---------	N	.1	.0039	.036	.058
92	do----	6.0	Continuation of sample 91; contorted, sheared, limey siltstone------------------	N	.1	.0015	.010	.028
93	do----	6.0	Through remainder of limey siltstone and sheared, friable limestone to fault contact with massive limestone--------------------	N	.1	.0021	.018	.027
94	do----	4.0	Three intersecting fault traces with zone of red, calcite-healed, intensely iron-oxide stained limestone-------------------------	N	N	.0015	.019	.040
95	Random chip--	NA	Fault trends N. 80° W. and dips vertically in dolomitic limestone; some breccia lenses with massive calcite pods; earthy hematite along fractures----------------------------	N	N	--	.03	.01

samples with detectable gold, 14 contained a trace, 17 ranged from 0.0002 to 0.23 oz/ton, and one contained 1.28 oz/ton. Silver is present throughout most of the deposit; 37 samples ranged from 0.04 to 0.9 oz/ton, 23 contained from 1.0 to 8.6 oz/ton, 8 contained from 12.8 to 56.6 oz/ton, and 1 contained 775.5 oz/ton silver. Sample 30 had the highest silver value and gold. Copper, lead, and zinc are present throughout the deposit; copper values generally were in the 0.001 to 0.01 percent range, while lead and zinc values were an order of magnitude higher. Five lead values and four zinc values occurred in the 1 to 5 percent range. The more significant precious-metal values most commonly occur in the large cross-break zones or in major splinter faults such as at the Rattler.

RESOURCE ESTIMATE: Much of the exposed part of the deposit is mined out; sample data are insufficient to block out a resource due to the sinuous and irregular nature of the replacement bodies. However, according to Weaco Resources, Ltd. (personnel commun., 1984), several promising intercepts were encountered by drilling at depth near the previously mined zones.

Dumps on the property are extensive; Tucker (1921, p. 361) reported that the main dump and a tailings pile contained 13,000 tons at a grade of 10 oz/ton silver. More recent estimates are based on a private company report by Keegel (1978, p. 7), including 16,000 tons of mine dumps which range from 3.2 to 7.7 oz/ton and average 4 oz/ton silver and 3,000 tons of mill tailings which contain about 4.4 oz/ton silver. The approximately 19,000 tons of inferred resources contained in dumps and tailings at the mine site have an average grade of 4.1 oz/ton silver. At the old Crow Town mill site near the 7IL (Blair) Ranch, there are 6,500 tons of mill tailings at a grade of 6.4 oz/ton silver, reflecting grade cutoff during the earliest episode of mining.

CONCLUSIONS: Based on historical production data, geologic mapping, sample analyses, and preliminary drilling data, the Bonanza King mine merits further investigation for additional silver, gold, lead, copper, and zinc resources at depth. Resources would most likely be contained in the zone which is bound by the major north-northeast-trending faults which do not extend into the study area except to the north of the Silver King mine (plate 1, no. 144); however, intensely faulted carbonate rocks to the west and northwest, towards the Tough Nut mine (plate 1, no. 112) area, may also contain resources of silver, gold, lead, copper, and zinc.

NAME: Grande 1-7 mine

OWNER: William Cline and heirs of Edwin Laster

INDEX MAP NO.: Plate 1, no. 150

LOCATION: E1/2 sec. 6, T. 10 N., R. 15 E., S.B.M.

ELEVATION: 3,920 to 4,080 ft.

ACCESS: About 11 mi northwest from Interstate 40 on Essex Road, then 4.5 mi north on dirt and four-wheel-drive roads to Bearclaw Well, then 0.4 mi north.

HISTORY: William and Virginia Frick located the Raindrop claims in December 1966. P. Lee Johnson located the Grande 1-7 claims in September 1975, and quitclaim deeded the claims to the late Edwin Laster in April 1980. Proofs of labor filed with the San Bernardino County Recorder indicate that some development work was conducted in 1979 and 1980.

PRODUCTION: There is no certain record of production from this property; however, Vredenburgh (1982) reported about 100 tons of unknown type ore production in 1980 from this or the Max Dor 1 and 2 mine.

GEOLOGY OF DEPOSIT: The deposit consists of one prominent vein system and three small veins or shear zones which cut Jurassic (?) granite (Miller and others, 1984b) (fig. A-50). Bonham and others (1959) identified the country rock as Precambrian metamorphosed plutonic rocks. The main structure crops out for approximately 400 ft along a northwest trend, and quartz float is observed for another 300 to 400 ft up hill to the north. Vertical exposure is 140 ft and the average thickness, based on seven samples across the structure (samples 4-10), is 2.7 ft. Along the main structure, quartz occurs as veins, pods, and blebs in a gray-green gouge zone. Some zones of gouge and granite are silicified; others are very friable and iron-oxide stained. Red jasperoidal material in a nearby pit contains galena and minor secondary copper materials.

WORKINGS AND FACILITIES: Workings consist of a 90-ft adit with an 8-ft winze, two 15-ft adits, and six pits. A large open cut and a network of roads give access to most of the workings.

SAMPLING: One select and nine chip samples were taken on the property. Sample locations are shown on figure A-50, and sample analyses are listed in the accompanying table. Gold was detected in two of three samples from small structures, 0.042 and 0.130 oz/ton, and in four of seven samples from the main vein, 0.010, 0.216, 2.144 and 2.182 oz/ton. The jasper contained 2.6 oz/ton silver, and three samples from the main vein contained 0.5, 3.2 and 9.4 oz/ton silver. Nine samples contained from 0.02 to 0.92 percent lead, and one contained 8.50 percent lead. Copper in four samples ranged from 0.02 to 0.26 percent.

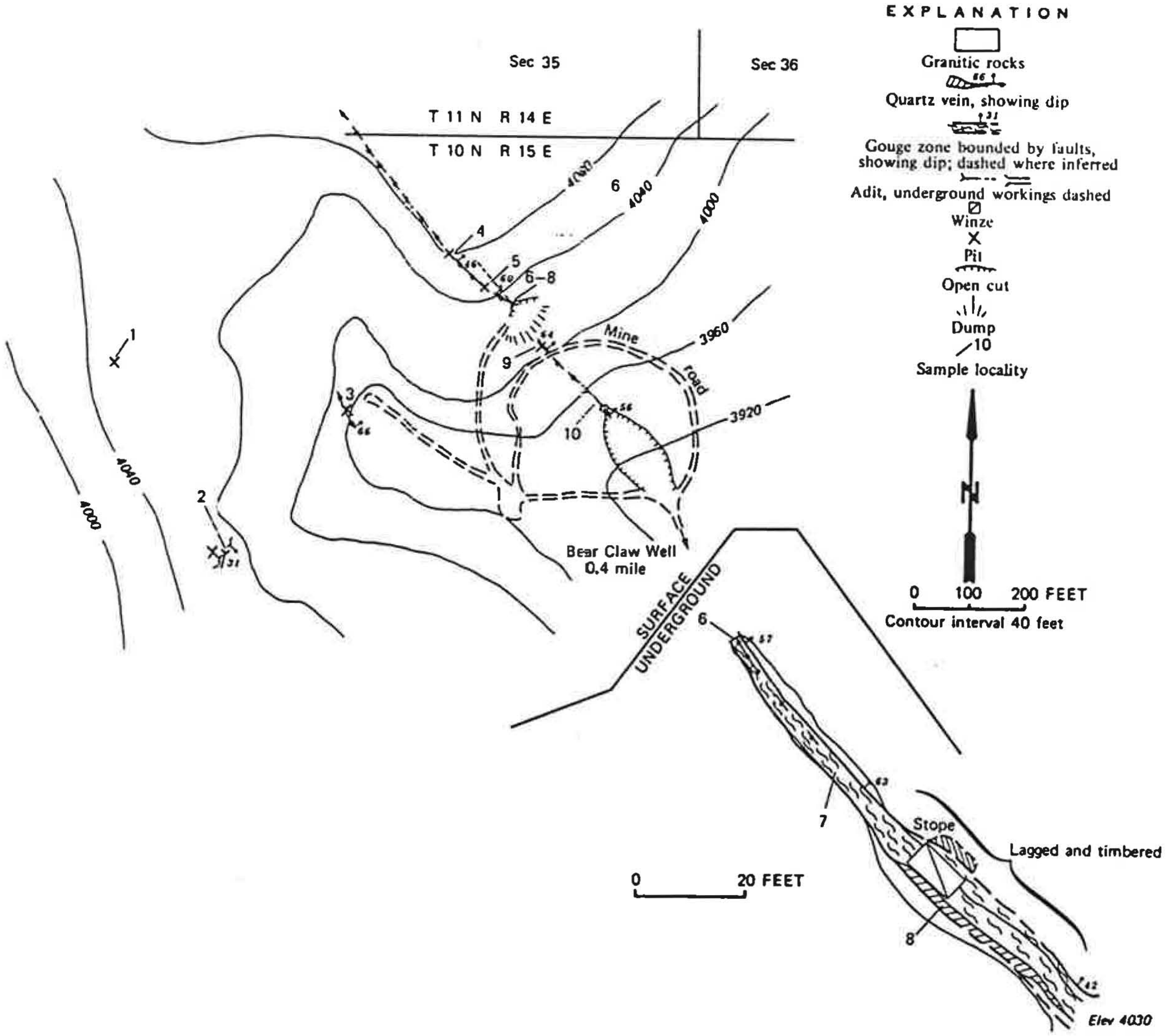


FIGURE A-50—Surface and underground maps, Grande 1—7 mine

Data for samples shown in figure A-50

[N, none detected; NA, not applicable]

Sample							
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
1	Select	NA	Jasper and hematite vein is 2 to 3 in. thick and contains galena and minor secondary copper minerals--	0.130	2.6	0.26	8.50
2	Chip--	1.5	Friable gouge and shear zone; nearby stockpile contains quartz with minor chalcopyrite and galena--	N	N	N	.05
3	do----	1.0	Quartz veinlets in breccia-gouge zone bound by felsic dikes--------------------------------------	.042	N	.02	.92
4	do----	3.0	Banded zone with 0.6-ft-thick quartz vein with boxwork, 1.0-ft-thick silicified gouge, country rock, and quartz stringers, and 1.4-ft-thick friable, iron-oxide stained gneiss---------------	2.182	9.4	.05	.37
5	do----	4.0	Quartz veins in gouge zone------------------------	.216	.5	.02	.65
6	do----	2.0	Gray-green fault gouge with iron oxide and minor quartz--	N	N	N	.04
7	do----	2.0	do---	2.144	3.2	N	.03
8	do----	1.3	Iron-oxide stained, clear quartz with minor sulfides; black streak of unknown inclusions---------------	.010	N	N	.08
9	do----	1.5	Quartz vein is 0.8 ft thick in chlorite gouge zone.	N	N	N	.12

Data for samples shown in figure A-50--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
10	Chip--	5.5	Gray-green, friable gouge between country rock and gray dike--	N	N	N	0.02

CONCLUSION: A few samples on the main structure contain very erratic gold and silver values; however, there is insufficient data to calculate a reliable grade and tonnage. The significant, but erratic gold and silver values, a prominent and persistent structure, and other significant gold and silver deposits in the vicinity suggest that further studies may reveal gold and silver resources at depth. Detailed sampling is needed to define a resource.

NAME: Max Dor 1 and 2 mine

OWNER: William Cline and heirs of Edwin Laster

INDEX MAP NO.: Plate 1, no. 153

LOCATION: SW1/4 sec. 5 and N1/2NW1/4 sec. 8, T. 10 N., R. 15 E., S.B.M.

ELEVATION: 3,935 to 4,068 ft.

ACCESS: About 11 mi northwest from Interstate 40 on Essex Road, then 4.5 mi north on dirt roads to Bearclaw Well, then 0.6 mi east.

HISTORY: Several workings were developed on the property prior to 1959 (Bonham and others, 1959, p. 2). P. Lee Johnson located the Max Dor 1 and 2 claims in September 1975, and quitclaim deeded the property to the late Edwin Laster in April 1980. Most of the workings were developed in the late 1970's and early 1980's.

PRODUCTION: There is no recorded production from this property; however, Vredenburgh (1982) reported about 100 tons of unknown type ore produced in 1980 from this or the Grande 1-7 mine.

GEOLOGY OF DEPOSIT: Two major structures are exposed on the property (fig. A-51). An east-trending, steeply north-dipping quartz vein is discontinuously exposed for 2,300 ft along strike, with a 300-ft south spur; a northwest-trending, steeply northeast-dipping fault or shear zone is exposed for approximately 350 ft. A shaft is at the intersection of these two structures. Several hundred feet north of the main workings, a large bulldozer cut is on a 100-ft long, northwest-trending quartz vein. The veins and fault cut probable Jurassic granite (Miller and others, 1984b). The location and trends of these structures correspond with a 100 gamma magnetic low (U.S. Geological Survey, 1981). Bonham and others (1959) identified the country rocks as Precambrian metamorphosed plutonic rocks.

Vein quartz is white to clear, iron-oxide stained, and commonly contains pyrite, chalcopyrite, malachite, and azurite. Veins range in thickness from 0.6 to 6.5 ft and are massive to brecciated with some boxworks and comb quartz observed. The fault is approximately 1 ft thick and is composed of green gouge, quartz veinlets or breccia, and earthy limonite.

Bonham and others (1959, p. 2) noted that a 30-ft-deep shaft and three trenches were developed on a northwest-trending vein in a shear zone. Pyrite, galena, limonite, and vanadinite ($Pb_5[VO_4]_3Cl$) were observed. It is assumed that these workings were destroyed by bulldozer work on the fault southeast of the main shaft.

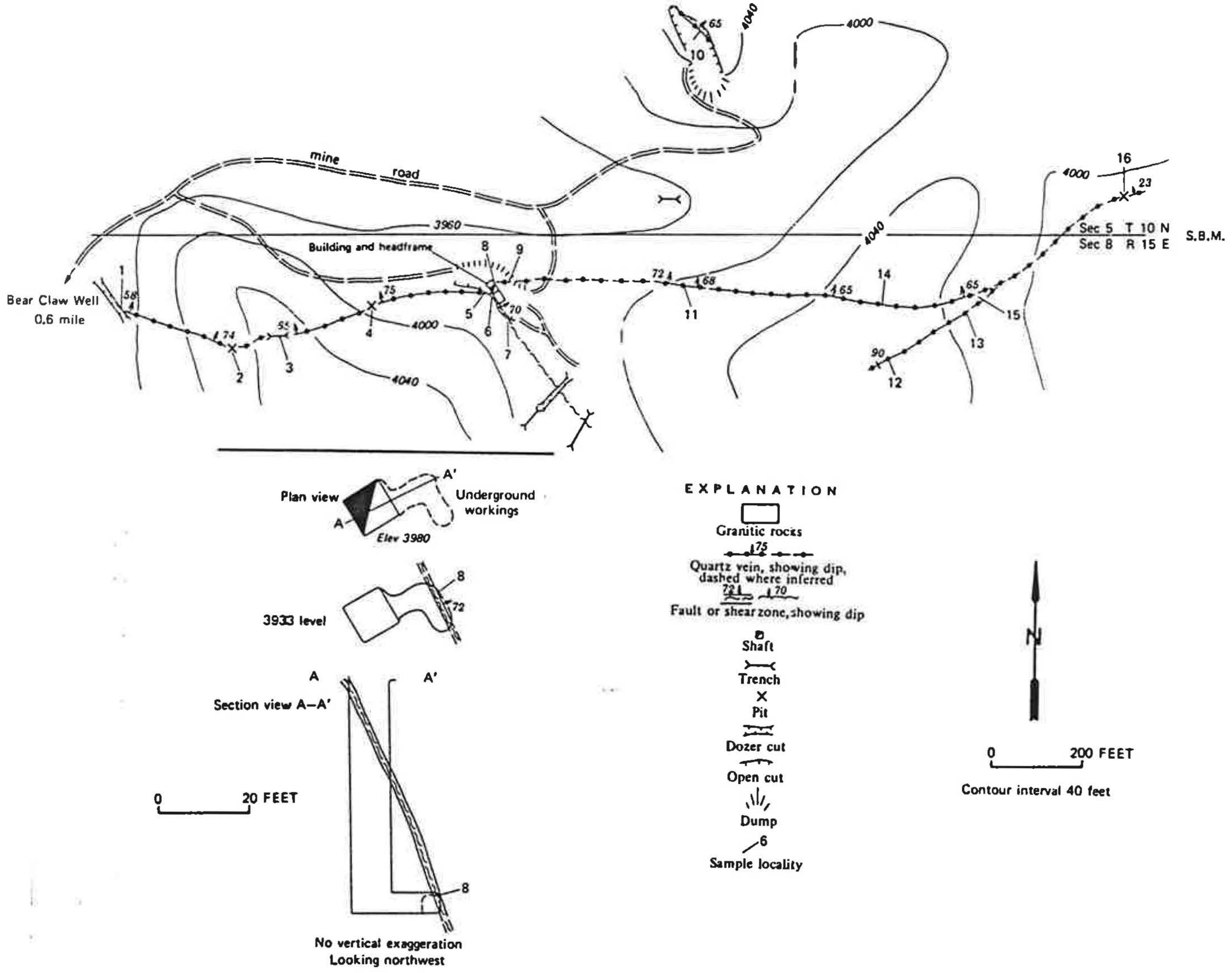


FIGURE A-51—Surface map, Max Dor 1 and 2 mine, with underground map and section of shaft

Data for samples shown in figure A-51

[N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
1	Chip	2.5	Massive quartz vein with minor chalcopyrite and hematite	0.020	N	0.01	0.01
2	Select	NA	From stockpile of quartz with visible secondary copper minerals, pyrite, and chalcopyrite; vein less than 6 in. thick	.052	N	.09	.14
3	Chip	6.5	Slightly limonite-stained quartz vein with stringers of secondary copper minerals and minor boxwork	N	N	.03	.01
4	do	4.0	Massive quartz with 8-in.-thick included country rock and 1-in.-thick zone densely speckled with chalcopyrite	N	N	.07	--
5	do	1.6	Fractured vein quartz with minor chalcopyrite	N	N	.01	.03
6	do	1.2	Fault zone with green chloritic gouge, iron-oxide stains and some quartz breccia	.590	0.3	.12	2.38
7	do	.9	Fault gouge with minor quartz veins	.012	N	.01	.14
8	do	1.0	Gouge zone with 1- to 2-in.-thick silicified zones and minor quartz veinlets in earthy limonite and clay gouge	.080	N	.02	.22
9	do	2.0	Iron-oxide-stained, massive quartz vein with some disseminated chalcopyrite and minor country rock clasts	N	N	.02	N

Data for samples shown in figure A-51--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
10	Chip--	0.8	Massive to brecciated quartz vein with altered sulfides; vein is banded with iron oxides---------	N	N	0.01	0.06
11	do----	2.0	Massive quartz vein interfingered with dark green, fine-grained dike; quartz contains minor secondary copper minerals and possible chalcopyrite---------------------------------------	N	N	N	N
12	do----	2.5	Massive-to-comb quartz vein with less than 1% boxworks and some angular country rock clasts-----	N	N	N	N
13	do----	1.1	Slightly iron-oxide-stained quartz----------------	N	N	N	N
14	do----	.8	Iron-oxide-stained quartz vein with pyrite and chalcopyrite speckled in stringers----------------	N	N	N	.01
15	do----	.8	Outcrop of massive, sinuous quartz vein with limonite in fractures-----------------------------	N	N	N	N
16	do----	.6	Iron-oxide-stained, slightly vuggy limonite fracture-filled quartz vein with pyrite and minor galena---------------------------------------	0.082	N	N	.05

WORKINGS AND FACILITIES: Workings consist of 3 small pits, an open pit, 4 trenches, 2 dozer cuts, and a 47-ft-deep shaft with 25 ft of crosscut and drift (figs. A-51). A small building with a headframe and ore chute are over the shaft.

SAMPLING: One select and 15 chip samples were taken on the property. The sample locations are shown on figure A-51, and the analyses are listed in the accompanying table. Gold was detected in 6 samples; 3 of 13 samples from the quartz veins contained from 0.020 to 0.082 oz/ton gold, and 3 samples from the fault contained from 0.012 to 0.590 oz/ton gold. One sample contained 0.3 oz/ton silver, 10 contained from 0.01 to 0.12 percent copper, and 10 contained from 0.01 to 2.38 percent lead. Overall, samples from the fault contained higher values than samples from the veins.

CONCLUSIONS: Significant but erratic gold is present in a quartz vein system and an intersecting fault; however, due to insufficient samples of the fault and low gold values in samples of the vein, a resource was not estimated. More detailed mapping and sampling may reveal a resource block. Based on the sample analyses, the prominence of the structures, and significant gold at nearby properties, this property merits further study for vein-type gold with byproduct silver and lead resources.

NAME: Gold Star North 1-44 and Gold Star 1-10 prospects

OWNER: Danny and Keith Hancock

INDEX MAP NO.: Plate 1, nos. 154 and 155

LOCATION: Sec. 4, E1/2 sec. 8, W1/2 sec. 9, T. 10 N., R. 15 E., sec. 31, T. 11 N., R. 15 E., S.B.M.

ELEVATION: 3,550 to 4,100 ft

ACCESS: About 10 mi northwest on Essex Road from Interstate 40, then 4.5 mi north on Black Canyon Road, and 2.5 mi west on four-wheel-drive roads.

HISTORY: Most workings on the property appear to predate the Hancock ownership. Eleven claims were located in the vicinity from 1907 to 1916, and eight claims were located in 1934 and 1935. The area was located as the Apex 1-43 in 1979 by Danny Hancock and as the Big Dipper 1-48 in 1980 by Sigo Mining Co. The property was relocated by the Hancocks in 1980-81 as the Gold Star 1-10 and the Gold Star North 1-44.

GEOLOGY OF DEPOSIT: The deposit consists of a north-northeast-trending, easterly-dipping zone of alteration over 1 mi long. Several shear zones, quartz veins, and dikes (?) crop out discontinuously within and near the alteration zone (fig. A-52). Alteration is characterized by red to orange iron-oxide-stained and decomposed country rock. Some areas have intense argillic alteration. The country rock is an altered, granitic-textured intrusive rock of intermediate to felsic composition. A nearly schistose, mafic intrusive rock crops out over a small area near the south end of the property.

The massive to vuggy quartz veins range from white to clear and are commonly iron-oxide stained. Pyrite, limonite pseudomorphs after pyrite, siderite ($FeCO_3$), specular hematite, chrysocolla, malachite, and azurite were observed at various locations on the property. Bonham and others (1959, p. 2) also reported chalcopyrite at two prospects in the north portions of secs. 8 and 9, T. 10 N., R. 15 E. S.B.M. The veins and gouge zones commonly crop out for only 50 to 100 ft; however, the vein system at the south end of the property can be traced for nearly 1,500 ft.

WORKINGS AND FACILITIES: The deposit is developed with 5 inclined shafts, 2 adits, 13 pits, and 2 trenches (fig. A-52). Dimensions of the shafts and adits are:

Working	Length or depth (ft)	Angle of workings from horizontal	Remarks
Shaft 1	50 ft	-50°	15-ft crosscut
2	20 ft	-34°	
3	55 ft	-40°	25-ft drift
4	30 ft	-50°	30-ft drift
5	17 ft	-30°	
Adit 1	60 ft		
2	20 ft		

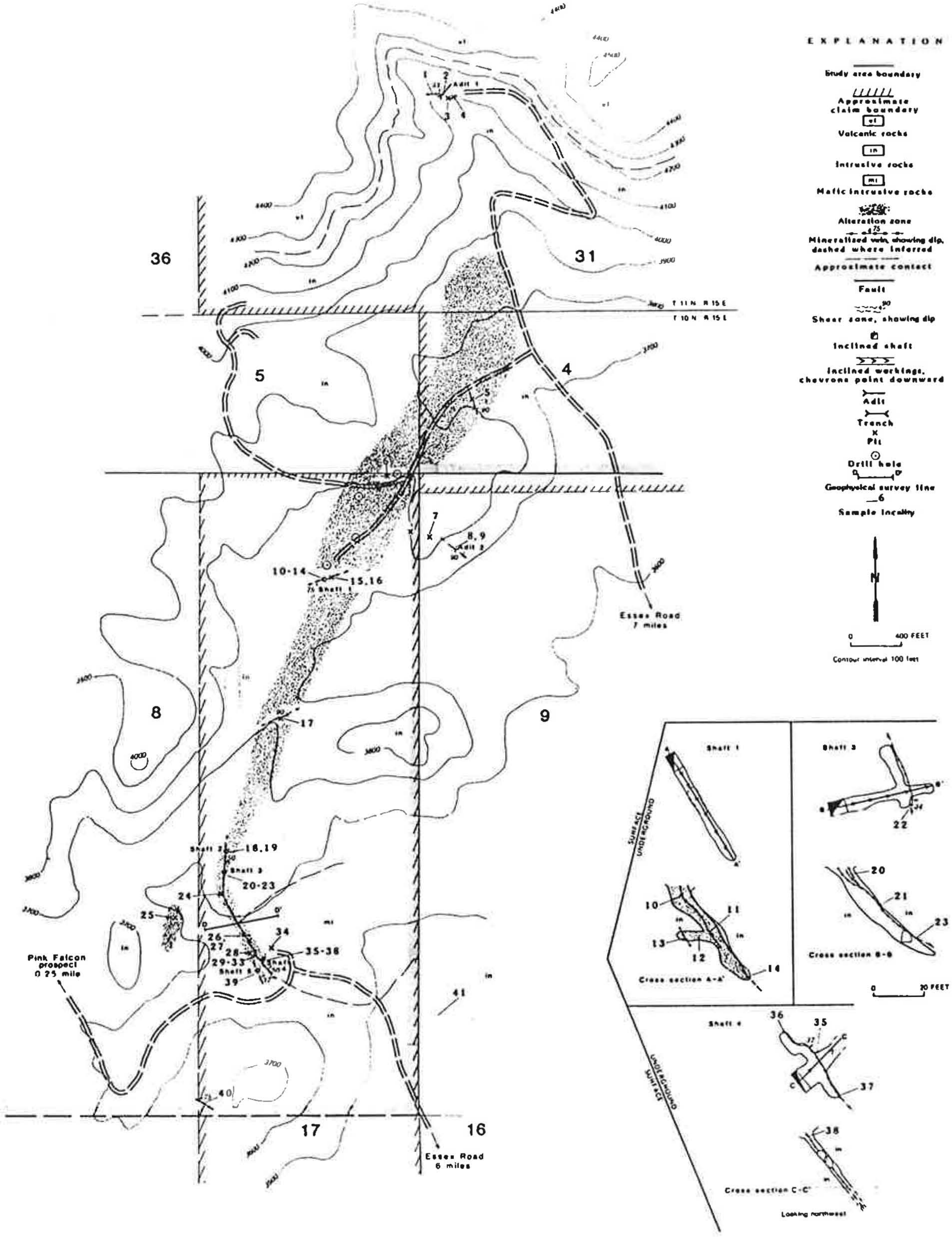


FIGURE A-52–Surface map, Gold Star North 1–44 and Gold Star 1–10 prospects, and underground maps and sections, shafts 1, 3, and 4

Data for samples shown in figure A-52

[Tr, trace; N, none detected; --, not analyzed; NA, not applicable]

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
1	Chip--	0.2	Vuggy, white quartz vein with abundant iron oxide---	0.022	N	--	--
2	do----	.1	Gouge zone---	N	N	--	--
3	do----	.4	Light gray, fine-grained dike-----------------------	.324	N	--	--
4	do----	2.8	Gouge zones enclose 9-in.-thick dike----------------	N	N	--	--
5	do----	1.0	Iron-oxide stained quartz vein in shear zone--------	N	N	N	N
6	do----	5.5	Shear zone contains quartz stringers, limonite after pyrite, and chrysocolla encrustations--------------	N	N	0.03	--
7	Select	NA	Stockpile contains 6-in.-thick quartz with iron oxide and secondary copper minerals----------------	.072	2.3	.54	--
8	Chip--	2.7	Fracture zone with quartz veinlets and iron oxide in altered granitic rocks--------------------------	.010	N	--	--
9	do----	.8	Subangular quartz breccia and chlorite-bearing gouge.	N	N	--	--
10	do----	5.5	Across 3-ft-thick quartz-bearing gouge zone enclosed by silicified iron-oxide-stained granitic rock-----	N	N	.20	--
11	do----	2.5	Silicified gouge-------------------------------------	N	.4	.22	--

Data for samples shown in figure A-52--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
12	Chip--	6.0	Gouge zone in granitic rock contains secondary copper minerals	N	N	0.25	--
13	do----	5.0	Chrysocolla stains along fault in massive granitic rock	N	N	.69	--
14	do----	3.7	Chlorite-bearing gouge and fracture zone with minor iron-oxide stains	N	N	.51	--
15	do----	2.0	Vuggy silicified zone with secondary copper mineral staining along fracture surfaces	N	N	.72	--
16	do----	7.8	Intensely fractured, sheared, silicified zone with minor secondary copper mineral stains	N	N	.22	--
17	do----	1.1	Vuggy, iron-oxide stained quartz vein in wide zone of gouge; minor secondary copper minerals in vugs	N	N	--	--
18	do----	1.2	Fault gouge with 1-in.-thick quartz stringers and chlorite along hanging wall	N	N	--	--
19	do----	2.0	Fractured granitic rock with abundant iron oxide	N	N	--	--
20	do----	5.0	Sheared granitic rock with 1-in.-thick stringers of iron-oxide stained quartz	Tr	N	.01	0.47
21	do----	1.2	Shear zone with quartz veinlets	0.060	N	.02	.11

Data for samples shown in figure A-52--Continued

Sample							
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
22	Chip--	2.0	Yellow, limonite-banded shear zone-----------------	N	N	0.01	0.04
23	do----	.5	Shear-gouge zone with clay and chlorite------------	0.072	N	.01	.03
24	Random chip--	NA	Quartz rich, iron-oxide stained, chloritically altered granitic rock----------------------------	N	N	--	--
25	Chip--	1.5	Bleached, weakly limonite-banded zone appears composed of argillite and possible calcite--------	N	N	--	--
26	do----	1.5	Chlorite-bearing shear zone with quartz veinlets---	N	N	--	--
27	Random chip--	NA	Through 10 ft of punky, limonite stained, altered granitic rock--------------------------------------	N	N	--	--
28	Chip--	3.0	Sheared, altered, iron-oxide stained granitic rock---	N	N	--	--
29	do----	3.0	Iron-oxide stained, fractured, buff colored, altered granitic rock with minor chlorite, specularite and calcite pods---------------------	N	N	--	--
30	do----	5.0	Through various intensely sheared and altered zones containing limonite, chlorite, and siliceous bands-----------------------------------	N	N	--	--
31	do----	1.9	Gouge with alternating bands of limonite and chlorite alteration------------------------------	N	N	--	--

Data for samples shown in figure A-52--Continued

Sample				Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
No.	Type	Length (ft)	Description				
32	Chip--	3.3	Fine-grained, brown, moderately fractured rock between shear zone and punky country rock	N	N	--	--
33	do----	2.0	Brown to black, coarse-grained, punky country rock	N	N	--	--
34	Random chip--	NA	Gray to black, medium- to coarse-grained, punky, mafic igneous rock with cross-cutting quartz veinlets	N	N	--	--
35	Chip--	2.0	Punky, buff colored shear zone below fine-grained (dike?) rock	N	N	--	--
36	do----	3.0	do	N	N	--	--
37	do----	1.8	Punky shear zone with iron-oxide stains	N	N	--	--
38	do----	1.5	Silicified, quartz rich, iron-oxide stained zone along hanging wall	N	N	--	--
39	do----	3.3	Silicified to punky, sheared granitic rock with a 6-in.-thick quartz vein	N	N	--	--
40	Random chip--	NA	Quartz pod, 5 ft thick, in felsic, dike-like ridge	N	N	--	--

Data for samples shown in figure A-52--Continued

Sample							
No.	Type	Length (ft)	Description	Gold (oz/ton)	Silver (oz/ton)	Copper (%)	Lead (%)
41	Select	NA	Mainly white quartz float; some pieces contain limonite after pyrite, specular hematite, minor epidote, and rare vugs with clear quartz and epidote--	N	N	0.0009	N

The Hancocks have taken 26 samples, run at least 20 electromagnetic survey lines, and developed 4 exploratory drill holes, adit 1, and a large trench adjacent to shaft 4. A network of four-wheel-drive roads provides access to most workings.

SAMPLING: The USBM took 35 chip, 4 random chip, and 2 select samples from workings and outcrops on the property. Sample locations are shown on figure A-52, and analyses are listed in the accompanying table. Seven samples contained detectable gold and two contained detectable silver. Values ranged from a trace to 0.324 oz/ton gold (average was 0.08 oz/ton) and 0.4 to 2.3 oz/ton silver. Of 15 samples analyzed for copper, 14 contained from 0.0009 to 0.72 percent, and 4 of 5 samples analyzed for lead contained 0.03 to 0.47 percent.

Over a period of two years, 26 samples taken by the Hancocks from workings and drill holes contained from a trace to 1.05 oz/ton gold (average was 0.25 oz/ton) and from a trace to 11.65 oz/ton silver (average was 1.6 oz/ton). The sample locations and types are unknown to the authors. The difference in gold values obtained by the USBM and the Hancocks might be explained by sampling methodology; however, the disparity in silver values is unresolved. Microprobe examination of a petrographic sample taken from site 41 revealed stringers of cerargyrite (AgCl). The electromagnetic surveys contracted by the claimants indicate a buried, eastward-dipping sulfide body. Geophysical surveys (electromagnetic and proton magnetometer) conducted by the USBM (figs. A-52 and A-53, section D-D') are not conclusive, but do not contradict the claimants' assertions.

CONCLUSIONS: Several generally northeast-trending, east-dipping quartz veins and shear zones are apparently related by a common alteration zone. The nature and depth of the controlling system are unknown but may be related to a contact zone or a buried conducting (probably sulfide) body. Based on erratic but significant assay values and the pervasive, intense alteration, this property merits additional investigation for small, moderate-grade, vein-type resources of gold and silver with possible sulfides.

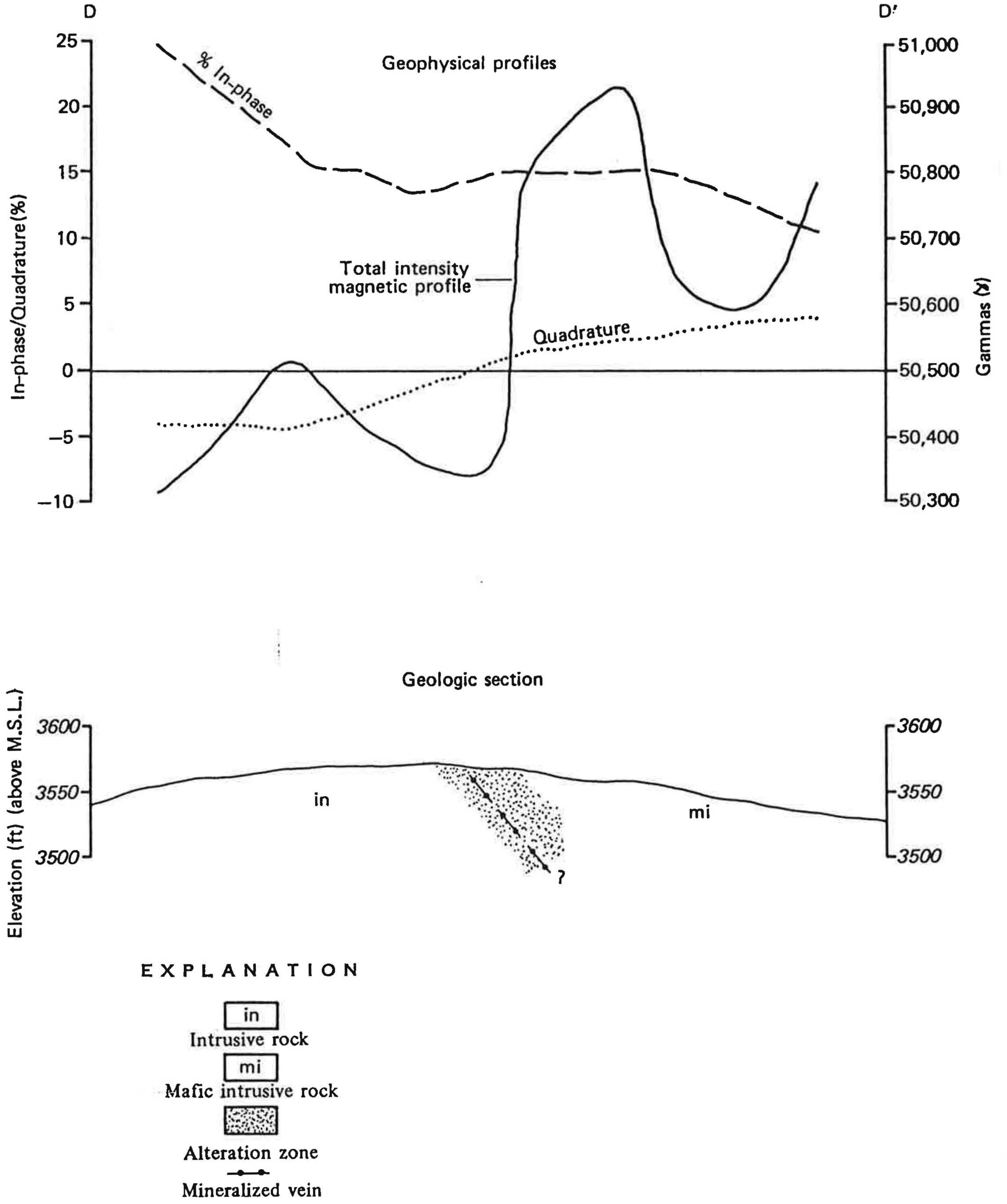


FIGURE A-53—Total intensity magnetic (proton magnetometer) and VLF electromagnetic profiles (three point running average) and a geologic section, D-D', Gold Star 1–10 prospect

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA

[Underlined names refer to properties with identified mineral resources or those which merit additional investigation for resources; those not underlined have little apparent significance or are insufficiently exposed to permit evaluation.]

(#, actively held mining claim(s); *, outside the study area; **, partly outside the study area; ≥, greater than or equal to; ≤ less than or equal to; <, less than)

Map no. (plate 1)	Name	Summary	Workings and production	Sample and resource data
1*	Prospect.	Granitic rock near a contact with gneiss hosts 1.0- to 4.0-ft-thick quartz veins in faults and shears which strike N. 55° E. to east and dip northwest or southeast. Quartz is white to gray, iron-oxide stained, and contains pyrite and minor secondary copper minerals.	Four pits and a 20-ft trench.	Of a total of one select and four chip samples, the select contained trace gold and three contained 0.2 to 0.8 oz/ton silver. Two contained 0.130% and 0.184% copper, 0.0042% and 0.010% lead, and 0.0017% and 0.0010% zinc. Analytical values and the nature of other properties in the vicinity indicate that the mineralized zones should be studied in detail to determine if vein-type silver resources are present.
2*	Prospect.	A quartz vein strikes N. 78° E. and dips 60° SE. and a quartz breccia zone strikes N. 80° W. and dips 53° SW. in or near an east-trending contact zone of Precambrian granite gneiss with intrusive granitic rock. The quartz contains pyrite, minor iron oxides, and sulfide boxwork.	Three pits.	Of two chip samples, one contained 0.1 oz/ton silver; no gold was detected.
3#**	Regulus-Vega-Spica prospect (Silver Fox shaft).	Workings are on northeast-trending, southeast- or northwest-dipping shear or fault zones and quartz veins. The Precambrian host rock is deeply weathered, lenticular to banded gneiss near a contact with granitic rock. Most structures are strongly sheared, moderately- to intensely-silicified, iron-oxide stained, and contain disseminated pyrite, limonite after pyrite, and some galena. Vein quartz is gray to white and contains pyrite, chalcopyrite, galena, sphalerite, malachite, chrysocolla, and azurite. This 400- to 500-ft-wide zone of sheared, altered, and mineralized rock may represent a northern projection of the East Providence fault.	A caved, 40-ft vertical shaft (Silver Fox), a 10-ft vertical shaft, an inclined shaft, a 20-ft trench, and 11 pits.	Of 13 chip, 1 random chip, 3 grab, and 5 select samples taken on the property, the 4 grab and select samples taken from the dumps and stockpile of the Silver Fox shaft contained from trace to 0.07 oz/ton gold and 0.4 to 2.6 oz/ton silver. No other gold values were detected. Three select samples from a quartz vein contained 1.4, 5.5, and 24.0 oz/ton silver; however, two chip samples across the structure contained less than 1 oz/ton silver. Of 13 samples analyzed for copper, 12 contained 0.0008% to 0.89% and one contained 4.7%. Twelve of 13 samples contained 0.0027% to 4.4% lead and 0.0054% to 0.65% zinc. Significant but erratic analytical values indicate that further investigation is necessary to determine if vein-type silver, gold, copper, or lead resources are present.
4	White Rock prospect.	A white to gray, pyrite- and iron-oxide-bearing, 0.5- to 5.0-ft-thick quartz vein approximately 2,000 ft long and oriented N. 20°-55° E., 32°-40° NW. is in granitic rock. The vein crosses a contact where it fills local shears in granite gneiss.	Three pits.	Six chip samples taken: no gold was detected; silver ranged from 0.1 to 1.0 oz/ton in five samples; one sample contained 0.0062% copper, 0.044% lead, and 0.0013% zinc. Sample values indicate the property merits additional investigation.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
5	Prospect.	A pyrite-, iron-oxide-, and secondary copper-mineral-bearing quartz vein occupies a fault approximately 550 ft long, striking N. 50°-60° E., and dipping vertical to 80° NW. The fault occurs in granitic rock 700 ft north of contact with granite gneiss.	Two shafts.	Five samples: no gold was detected; four contained 0.1 to 0.3 oz/ton silver; copper ranged from 0.0019% to 0.086%.
6	Prospect.	Variably oriented, coarse grained, felsic dikes, approximately 4 in. thick, in deeply weathered granitic rock.	One pit.	One sample contained no gold or silver, 0.0069% copper, 0.0055% lead, and 0.0067% zinc.
7#	Red Silver prospect.	A 2-ft-thick quartz vein strikes N. 40°-70° E. and dips 65° NW. for at least 550 ft in granitic rock. The vein is white to gray, has massive to comb quartz structure, and contains 1% pyrite and galena, minor secondary copper minerals, and abundant iron oxide boxworks.	One 50-ft trench and two pits.	Of two chip and one select sample, one contained 0.01 oz/ ton gold, silver ranged from 0.7 to 3.5 oz/ton, copper ranged from 0.0021% to 0.103%, lead ranged from 0.073% to 0.67%, and zinc ranged from 0.0004% to 0.0024%. Size and persistence of the structure and the analytical values indicate the property merits additional investigation for vein-type silver resources with byproduct lead and copper.
8**	Prospect.	Two quartz veins and a quartz-bearing shear zone occur in deeply weathered Precambrian granite gneiss. One vein strikes east and dips 60° N. and the other strikes N. 30° E. and dips 40° SE.; the shear zone strikes east and dips 30° S. Quartz is massive, white, and contains pyrite, galena, secondary copper minerals, iron oxides, and minor boxwork structures.	One 40-ft inclined shaft and two pits.	One chip and three select samples were taken. No gold was detected. A chip and a select sample from the east-striking vein contained 2.2 and 1.8 oz/ton silver, 0.039% and 0.024% copper, 1.32% and 0.76% lead, 0.12% and 0.093% zinc, and 0.0044% and 0.0030% molybdenum. A select sample from the N. 30° E. vein contained 24.8 oz/ton silver, 0.044% copper, 0.091% lead, 0.33% zinc, and 0.0023% molybdenum. Analytical values and the nature of other properties in the vicinity indicate vein-type resources of silver, lead, and zinc may be present.
9	Prospect.	A northeast-trending, southeast-dipping, 20-ft-thick fault zone is in granite gneiss. The zone consists of gray-to-brown banded clay.	Two pits.	One sample contained no detectable gold, 0.2 oz/ton silver, 0.0046% copper, 0.0084% lead, and 0.014% zinc.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
10#	Silver Buddy mine.	Granite gneiss hosts northeast-trending, northwest-dipping quartz veins, pods, and shear zones. Quartz is white to gray, iron-oxide stained, and has visible limonite after pyrite, disseminated galena, minor sphalerite, and secondary copper minerals. Boxworks are common and comb structures are rare. The main vein crops out discontinously for 220 ft along strike and continuously 90 ft downdip, ranges in thickness from 0.1 to 2.5 ft, and may be continuous with a 240-ft shear zone.	One 90-ft adit with a raise and 55 ft of drifts, five bulldozed open cuts totalling 650 ft, two trenches, and two pits. From 10 tons (USBM statistical files) produced in 1965, 22 oz of silver, 1 lb of copper, and 142 lb of lead were recovered.	There is a mineral occurrence of 1,300 tons at 3.3 oz/ton silver and 1.24% lead. Of one select and nine chip samples taken, six chip samples on the main vein contained 0.6 to 6.9 oz/ton silver, 0.011% to 0.077% copper, 0.36% to 2.04% lead, and 0.0021% to 0.081% zinc; a select sample from the stockpile contained 0.592 oz/ton silver, 1.65% lead, and less than 1% copper and zinc. Two chip samples from other quartz outcrops contained 1.1 and 3.6 oz/ton silver. A shear zone sample contained no silver and only minor copper, lead, and zinc. The exposed vein is of limited extent but the minor past production and sporadically high sample values indicate this property may have additional silver, lead, and copper resources.
11#	Silver Buddy prospect, south.	Quartz veins, a shear zone, and a fault are in granite gneiss. The main vein crops out for 1,000 ft, strikes N. 50°-72° E., dips 43°-50° NW., and contains pyrite and galena. A N. 87° E. striking, 40° SE. dipping quartz vein of short outcrop length bears visible galena and is offset 7 ft by a north-trending, westerly-dipping normal fault. An east-trending, 65° S. dipping shear zone has blebs of galena. An epidote- and specularite-rich, skarn zone is also in granite gneiss.	Two inclined shafts and five pits.	Seven samples were taken on the property. Of three chip samples on the main vein, no gold or silver was detected and one sample analyzed contained 0.0075% copper, 0.51% lead, and 0.026% zinc. A select sample contained no gold, 0.5 oz/ton silver, 0.125% copper, 1.78% lead, and 0.53% zinc. A sample from the small quartz vein analyzed 0.1 oz/ton gold, 2.4 oz/ton silver, 0.057% copper, 2.86% lead, and 0.64% zinc. A shear zone sample contained a trace gold, 4.4 oz/ton silver, 0.023% copper, 0.291% lead, and 1.03% zinc. A sample from the skarn zone had 0.034% copper and no detectable gold, silver, molybdenum, tin, or tungsten. Sporadic but significant analytical values suggest the property merits additional investigation for silver and gold resources with byproduct lead, zinc, and copper.
12*	Prospect.	A 1-ft-thick fault zone trends N. 25° E. and dips 30° NW. in Precambrian gneiss and schist. Several other fault and shear zones with various attitudes are present.	One adit 110 ft long.	One chip sample contained a trace gold and no silver.
13#*	Sadr prospect.	Quartz veins and a gouge zone are 3.5 ft thick, strike N. 60° W. and dip 60° SW. in Precambrian gneiss. Quartz and argillized gneiss contain 1% to 2% pyrite and iron oxides.	One inclined shaft caved at 10 ft.	One chip and two select samples taken; a select sample from the dump contained a trace gold, 0.2 oz/ton silver, 0.0039% copper, 0.033% lead, 0.011% zinc, and 0.028% molybdenum; a select sample from the stockpile contained no gold and 0.9 oz/ton silver; the chip sample contained no gold, 0.4 oz/ton silver, 0.051% copper, 0.299% lead, and 0.026% zinc. Analytical values and similar deposits in the vicinity indicate that further studies for vein-type silver, lead, and gold resources are warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
14*	Fremont-Easy Street prospect.	Several outcrops of north- to-northwest-trending, mostly northeast-dipping quartz veins and silicified shear zones are in Precambrian gneiss. Quartz is gray to white and contains from nil to abundant pyrite (none observed in higher grade samples) and minor manganese oxides.	Two 10-ft shafts and eight pits.	Of one grab and five chip samples, four contained from 0.01 to 0.45 oz/ton gold and all contained silver in the range of 0.02 to 2.5 oz/ton. One sample analyzed for base metals contained 0.020% copper, 0.51% lead, and 0.017% zinc. Erratic but significant assay values indicate this property should be studied in detail to determine whether or not vein-type gold, silver, and lead resources are present.
15**	Prospect.	White to gray-green quartz crops out in granite gneiss. One outcrop is apparently barren and the other contains galena, iron oxides, and boxwork. No structural controls are evident.	Two pits.	One grab sample contained no gold or silver and one select sample contained 0.01 oz/ton gold, 1.5 oz/ton silver, 0.021% copper, 2.59% lead, and 0.028% zinc. Analytical values and nearby deposits indicate further studies for vein-type silver, gold, and lead resources are warranted.
16*	Prospect.	A N. 70°-75° E. striking, 72°-75° S. dipping shear zone with boxwork structures is in intensely silicified granitic rock. The zone is exposed over 200 ft along strike and may be continuous with the zone at the Denib mine (no. 17).	One 36-ft adit and a 55-ft open cut.	Two chip samples contained no detectable gold and 0.1 to 0.2 oz/ton silver.
17*	Denib mine.	A sulfide-bearing shear zone is as much as 20-ft thick, strikes N. 63°-80° E., and dips 70°-77° SE. in deeply weathered, banded gneiss and schist. The zone is argillized and contains quartz stringers and as much as 20% disseminated pyrite. Secondary, northeast-trending, northwest-dipping shear zones contain pervasive pyrite.	Two adits: the lower is a 108-ft crosscut, the upper has 151 ft of crosscuts and 190 ft of drifts with stopes. Stopes and a retort indicate probable minor production.	Eight chip and two grab samples were taken. Of the two grab samples, one contained a trace gold, 1.3 oz/ton silver, 0.063% copper, 0.59% lead, and 1.04% zinc and the other contained no gold, 0.2 oz/ton silver, and was not analyzed for other elements. Of the eight chip samples, one contained a trace gold, six contained 0.1 to 0.2 oz/ton silver, and six contained from 0.0046% to 0.058% copper, 0.0063% to 0.214% lead, and 0.011% to 0.188% zinc. The size of the zone, stoping in the workings, and the spotty but significant analytical values indicate that further investigation may reveal silver, gold, lead, and zinc resources at depth.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
18*	Blue Rock Nos. 1-6 mine (Confidence Copper mine).	Quartz veins striking N. 75° W. and dipping southwest in Mesozoic granitic rocks exhibiting sericitic alteration, are intersected by veins striking N. 75° E. and dipping 65° SE. The main vein crops out for at least 400 ft along strike, is 3 to 5 ft thick and developed to a depth of 100 ft. Quartz is massive to brecciated, white to gray, iron-oxide-stained, and has some comb structures. Pyrite, limonite after pyrite, chalcopyrite, chrysocolla, malachite, azurite, sphalerite, and wolframite were observed. Microprobe examination detected the oxides of bismuth, antimony, and lead as well as the minerals magnetite, barite, scheelite, and huebnerite with crosscutting seams of stolzite or raspite ($PbWO_4$).	One shallow vertical shaft, two inclined shafts (one inclined 65° S. for 100 ft), one combination adit and open cut, two 80-ft bulldozer cuts, one 40-ft open cut, a 20-ft trench, and five pits. Small shipments of tungsten ore made in 1918 (Cloudman and others, 1919, p. 849). Tucker (1921, p. 340) noted the presence of $8/ton ($20/oz) gold.	Four chip, one random chip, one grab, and one select sample were taken. The select contained 0.04 oz/ton gold, 34.2 oz/ton silver, 1.17% copper, and 1.2% tungsten. No other gold detected. Of the remaining samples, silver ranged from 0.1 to 3.3 oz/ton, copper from 0.0058% to 0.53%, tungsten from 0.0028% to 1.0%, lead from 0.0049% to 0.52%, zinc from 0.0047% to 0.112%, and molybdenum from nil to 0.0053%. Two samples contained 0.0006% and 0.0008% tin and four analyzed for fluorine contained 0.11% to 1.0%. The past production and analytical values of this deposit, and the nature and size of similar deposits in the area suggest that further studies for tungsten-, silver-, gold-, and copper-bearing resources at depth are warranted. Deposits may be about 5,000 to 15,000 tons but further investigation is needed.
19*	Prospect.	A N. 55° E. striking, vertical-dipping gray-green andesite dike and a N. 30° W. striking, 85° SW. dipping, graphic-textured dike composed of coarse quartz and potassium feldspar intrude shear zones in Mesozoic granite.	Three pits.	One chip sample contained no detectable gold or silver.
20*	Prospect.	Lenticular to banded gneiss with iron-oxide stained quartz contains minor pyrite.	One pit.	One grab sample contained no gold and 0.5 oz/ton silver. Sample analysis suggests further studies are needed.
21*	Prospect.	A prominent, N. 60° W. striking, 45° NE. dipping alteration zone containing abundant quartz and pyrite and a barren, N. 45° E. striking, 60° SE. dipping dike are in country rock. The quartz zone cannot be traced but may be related to many veins on the Confidence Copper and Francis mine properties.	One caved shaft and one pit.	One select sample contained no detectable gold, 0.3 oz/ton silver, 0.0053% copper, 0.0210% lead, no detectable zinc, and 0.0064% molybdenum. No gold or silver was detected in one chip sample taken on the dike.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
22*	Francis mine.	The Cuyamaca vein is 5 to 10 ft thick, strikes N. 60°-70° E. and dips 65° to 85° NW. in sheared, bleached, Precambrian granite gneiss vertically proximal to Mesozoic granitic rocks. The white to translucent gray, iron-oxide stained quartz contains pyrite, limonite after pyrite, galena, chalcopyrite, sphalerite, fluorite, possible scheelite and/or wolframite. The vein crops out for 1,700 ft and may continue another 800 ft along strike.	Workings include six shafts from 40 to 140 ft deep, three adits from approximately 30 to 120 ft long, and three pits. Production was at least 200 tons (USBM statistical files) containing 2,377 oz silver (average 11.9 oz/ton) and 10,626 lb copper (average 2.7%). Tucker (1918b) reported 500 tons produced.	Six chip, two random chip, five grab, and two select samples taken on the property. Three samples contained a trace gold. Copper, lead, and zinc values were slight to moderate, never exceeding 1% for 13 samples analyzed. Thirteen samples contained from 0.1 to 5.8 oz/ton silver with 7 ranging from 1.0 to 5.8 oz/ton. Two of 12 samples contained 0.0022% molybdenum, 6 of 11 samples contained 0.0006% to 0.0008% tungsten and 9 of 11 samples contained 0.0005% to 0.0038% tin. Fluorine ranged from 0.1% to 1.0% in five samples analyzed. Tucker and Sampson (1930) noted the overall ore grades ranged from 2 to 25 oz/ton silver, 2% to 12% copper, 1% to 6% lead, and 4% to 20% zinc. Past production, persistence of the veins, and consistently significant silver values and the presence of copper, lead, and zinc in samples indicate this property merits further investigation; individual pods may be about 5,000 to 10,000 tons.
23*	Castor-Pollux mine (Columbia mine, Macedonia mine).	The main workings are on two or more east-northeast-trending, moderately southeast-dipping quartz veins and shear zones in Precambrian lenticular to banded gneiss above a granitic contact. Pyrite, chalcopyrite, galena, sphalerite, calcite, and occasional fluorite are associated with quartz and silicified zones. A grab sample from the dump contained as much as 30% sulfides. One vein is exposed for 500 ft along strike.	Four shafts (one is 320 to 350 ft deep), three adits, one trench, and three pits. In four years, from 1926-1938, a total of 142 tons (USBM statistical files) of ore containing 89.11 oz gold, 2,167 oz silver, 2,626 lb copper, and 100 lb lead were produced.	An estimated 5,600 tons of indicated and 18,000 tons of inferred subeconomic resources, averaging 0.05 oz/ton gold and 9.1 oz/ton silver, are contained in the exposed quartz vein. Of 17 chip and random chip, 5 grab, and 2 select samples taken on the property, gold ranged from trace to 0.11 oz/ton in 13 samples and silver ranged from 0.1 to 25.2 oz/ton in 24 samples. Copper, lead, and zinc were present in moderate amounts, but less than 1% in all samples. Additional resources of gold and silver with byproduct copper, lead, and zinc may be contained in the main vein system which was inaccessible.
24*	Monte Video prospect.	Variably oriented, white to gray, iron-oxide stained quartz veins occur in localized shear zones in weathered, friable lenticular to banded gneiss. The quartz contains minor pyrite and boxworks; fluorite was observed in quartz porphyry in one adit.	Two adits (8 ft and 70 ft) and 14 pits.	Seven chip and two select samples: one sample contained a trace gold; six contained 0.1 to 0.2 oz/ton silver; four samples contained 0.0006% to 0.0026% copper, nil to 0.014% lead, and nil to 0.0054% zinc. One of three samples analyzed contained 0.0016% molybdenum; two samples contained 0.0010% and 0.0020% tungsten, and nil and 0.0005% tin; one sample analyzed for fluorine contained 0.40%. Analytical values are low but the presence of gold and silver indicate that further studies are warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
25	Prospect.	Approximately N. 60° E. striking, variably-dipping, bleached, iron-oxide stained, silicified shear zone and fault gouge 1 to 6 ft thick in gneiss; minor iron sulfides noted in crosscutting quartz vein 6 in. thick at workface. May be related to a breccia pipe a few hundred feet west of the portal.	One adit, 160 ft long.	Of six chip samples, three contained 0.1 to 0.2 oz/ton silver, two contained 0.0017% and 0.0041% lead, and six contained 0.0055% to 0.027% copper and 0.012% to 0.075% zinc. Higher values from vein at working face.
26	Prospect.	About a 1-ft-thick zone of gouge and minor quartz occurs along a fault striking N. 60° E. and dipping 84° SE. in sericitically altered gneiss.	One adit, 21 ft long.	One random chip sample contained 0.0043% copper, 0.0074% lead, and 0.0083% zinc; no gold, silver, or molybdenum were detected.
27	Fanny No. 2 prospect.	Two silicified fault or shear zones strike N. 70° E. and dip 52° SE. to vertical in gneiss; the zones are silicified, iron-oxide stained, and contain massive to brecciated quartz with sericite.	One adit, 6 ft long, and one pit.	Of two chip samples, one contained 0.02 oz/ton gold and two contained 0.1 and 0.5 oz/ton silver; one sample had 0.0029% copper, nil lead, 0.0021% zinc, 0.02% molybdenum, and 0.0006% tungsten. Gold and silver analyses indicate that the property merits further investigation for resources.
28	Prospect.	A 4-ft-thick shear or fault zone containing a quartz vein strikes N. 70° E. and dips 78° SE. in altered gneiss; quartz is translucent gray with minor limonite after pyrite and the gneiss is sheared, bleached, altered to sericite and chlorite and contains abundant boxwork.	One inclined shaft 26 ft deep.	One grab sample from the dump contained 0.02 oz/ton gold, 0.4 oz/ton silver, 0.015% copper, 0.0094% lead, and 0.0095% zinc. Mineralization and alteration indicate that further studies for vein-type gold resources are warranted.
29	Rex Nos. 1 and 2 prospect.	Northeast-trending, vertical- to southeast-dipping silicified zones in granite gneiss are 3 to 9 ft thick. Gneiss is fractured and foliated; silicified zones are formed by quartz vein swarms and by silica replacement of altered gneiss. One zone crops out for 100 ft.	One 20-ft-long adit, one 15-ft-long trench, and two pits.	Three chip samples contained 0.1 to 0.2 oz/ton silver, 0.0073% to 0.021% copper, 0.0021% to 0.028% lead, and 0.0040% to 0.043% zinc.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
30	Prospect.	Workings expose 3- to 6-ft-thick, fine- to medium-grained, quartz latite dikes (?) in two northeast-trending, southeast-dipping and one northwest-trending, northeast-dipping shear zones in granite gneiss. Zones are silicified, iron-oxide stained, and contain quartz veinlets, sericite, and abundant pyrite with minor galena. The extent of the system of veins and dikes is unknown.	One short adit, one shallow shaft, and three pits.	Of two chip and two select samples, gold was detected in two samples, trace and 0.05 oz/ton. Silver ranged from 0.3 to 2.0 oz/ton, copper from 0.0053% to 0.095%, lead from 0.0036% to 0.020% and zinc from 0.0032% to 0.094%. The intensity and type of alteration and the gold and silver values indicate that the property merits additional study.
31	Prospect.	Two quartz-bearing fault zones occur in granite gneiss. The main zone strikes N. 60° W., dips 55°-80° NE., averages 6.4 ft thick, and is inferred for 350 ft along strike. Quartz is white to gray, iron-oxide stained, and contains sulfide stringers, limonite after pyrite, and secondary copper minerals. Fault gouge is gray-green and silicified and gneiss near the zone is bleached. A second quartz vein, which crops out 300 ft south of the main zone, strikes north, dips 30° E., and is 5.5 ft thick.	One flooded adit of unknown length and three pits.	The deposit contains an inferred subeconomic resource of approximately 35,000 tons at an average grade of 0.04 oz/ton gold and 0.6 oz/ton silver. Of one chip sample from the north-striking vein and a select and five chip samples from the main vein, all but a select sample from the dump contained gold and all contained silver. Five samples contained 0.0046% to 0.0270% copper, 0.0440% to 0.27% lead, 0.0007% to 0.0400% zinc, and 0.0033% to 0.0420% molybdenum. Alteration, size of exposed deposit, and analytical values indicate additional vein-type gold and silver resources may be present.
32	Dixie No. 2 prospect.	Two shear or fault zones occur in granite gneiss. The main shear zone consists of gray quartz and fault gouge trending east and dipping 60°-85° S., crops out for 350 ft along strike, and averages 3.4 ft thick. Quartz and pyrite are abundant along with minor galena and sphalerite, and traces of argentite, chalcocite, and barite. Gneiss near the vein is bleached and exhibits sericitic alteration. A localized, north-trending shear zone is 400 ft north of the main zone.	A 56-ft adit, a 10-ft shaft, and five pits on the main shear zone; one pit on the shear zone.	The main shear zone contains an inferred subeconomic resource of approximately 17,000 tons at an average grade of 0.01 oz/ton gold and 1.0 oz/ton silver. Eight of nine samples from the main shear zone contained 0.0019% to 0.011% copper, 0.012% to 0.059% lead, and 0.0031% to 0.0071% molybdenum. Three samples contained 0.021% to 0.35% zinc. No gold or silver were detected in the localized shear zones. Sample analyses and the extent of the vein indicate that additional gold and silver resources may be associated with the deposit.
33	Prospect.	A 2-ft-thick quartz-rich structure (shear?) strikes N. 75° W. and dips 40° SW. in buff to brown medium-grained granite gneiss; extent of the structure is unknown.	One shaft and two pits.	One chip sample taken contained 0.21 oz/ton gold and 1.0 oz/ton silver. Although the extent of the structure is unknown, the sample analysis and the proximity of significant deposits to the west indicate the property merits further investigation.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
34	SS No. 28 prospect, north.	A 2- to 10-ft-thick zone of quartz, quartz-sericite, and gouge strikes N. 45° E. and dips 74°-90° NW. in a fine- to medium-grained, silicified, intensely sericitized, felsic igneous dike or plug which has intruded granite gneiss. The zone averages 3.2 ft thick, crops out for 270 ft along strike, has a 96-ft vertical exposure, and horsetails to the north. The quartz-sericite zone also contains minor potassium feldspar, 3% to 5% euhedral pyrite, and 1% to 3% jarosite after pyrite.	An 80-ft adit with a 5-ft winze and a 16-ft raise to the surface.	The deposit contains an inferred subeconomic resource of approximately 10,000 tons at an average grade of 0.02 oz/ton gold and 0.9 oz/ton silver. Six of nine chip samples contained gold, which ranged from trace to 0.07 oz/ton, and seven samples contained silver, which ranged from 0.1 to 3.5 oz/ton. Copper values ranged from 0.0055% to 0.114%, lead ranged from 0.0021% to 0.042%, and zinc ranged from 0.0020% to 0.022%. The sample analyses and the geologic environment indicate that additional resources of vein-type gold and silver may be present.
35#	SS No. 29 prospect, north.	A northeast-trending, northwest-dipping, 1- to 5-ft-thick zone of gray to buff quartz and intensely bleached, silicified gneiss with some gouge and disseminated sulfides cuts gneiss for 190 ft. The country rock is very friable and altered, and may be intruded by and interfingered with intensely altered felsic volcanic rock.	Two adits, 115 ft and 52 ft long, one open cut and one pit.	The deposit contains an indicated subeconomic resource of 3,000 tons and an inferred subeconomic resource of 12,000 tons both at an average grade of 0.05 oz/ton gold and 1.7 oz/ton silver. One select, one random chip, and 14 chip samples were taken. Ten contained detectable gold, values ranged from 0.01 to 0.21 oz/ton, and all contained silver, values ranged from 0.2 to 3.5 oz/ton; copper values ranged from 0.019% to 0.28%, except one at 1.39% copper, and lead values ranged from 0.0021% to 0.48%; 10 samples contained from 0.0023% to 0.0044% molybdenum and 3 of 11 samples analyzed for tungsten contained from 0.0006% to 0.0220%. The significant sample analyses, the prominence of the vein, and the proximity of other notable properties suggest the present of additional gold and silver resources. Persistent anomalous molybdenum values indicate further studies are warranted.
36	Prospect.	Two silicified zones: the first, a felsic dike, strikes N. 32° E. and dips 65° SE., and the other strikes N. 20° E. and dips 80° SE. in gneiss. Dike is gray to brown, medium-grained, quartz-rich, and contains iron oxides and boxwork structures.	Two pits.	A chip sample from the silicified dike contained 0.03 oz/ton gold and 1.8 oz/ton silver, and a dump grab from the silicified zone in gneiss contained 0.5 oz/ton silver. Copper values were 0.033% and 0.0092%, lead values 0.236% and 0.062%, and zinc values 0.019% and 0.0020%, respectively. Although no resource is identified, assay values indicate the property merits further investigation for gold and silver resources.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
37#	SS Nos. 17-19 prospect, north.	Two east-trending mineralized structures and several small shear zones cut altered silicified gneiss and are related to mineralized felsic volcanic rocks which exhibit seritic alteration. A 2.0- to 3.5-ft-thick quartz vein crops out for 200 ft and dips steeply to the north. A 4- to 10-ft-thick, 110-ft-long massive stratiform body is composed predominantly of a yellow, red, brown, and black iron-oxide replacement and is interfingered with quartz veinlets and silicified gneiss. It is underlain by altered, punky gneiss and overlain by felsic rock exhibiting quartz-sericite alteration. Halotrichite ($FeAl_2[SO_4]_4 22H_2O$) has weathered from the massive, oxidized, iron body.	Four adits, a caved shaft, two pits, and a trench; one adit is flooded, one is 20 ft long, one is 26 ft long with a winze, and one has 70 ft of crosscut and 40 ft of raise to two inclined shafts. Three holes were drilled on the property.	Of 16 chip, 3 random chip, and a select sample, 6 contained detectable gold, from a trace to 0.03 oz/ton, and 13 contained silver, from 0.039 to 1.4 oz/ton. Copper ranged from 0.0054% to 0.055%, lead from 0.0027% to 0.33%, and zinc from 0.0010% to 1.16%; six of seven samples contained from 0.0036% to 0.031% molybdenum, and one sample from the stratiform body contained 25% iron. The higher gold and silver values are from the quartz vein while the higher molybdenum values are associated with the stratiform body. Significant sample values for gold, silver, zinc, and molybdenum, and similar deposits with resources in the area, indicate the property merits additional investigation.
38	SS Nos. 20-22, 27-29 mine, south (Star[?] mine)	Three prominent, subparallel quartz veins and several smaller veins strike N. 50°-70° E., dip northwest or southeast and cut gneissic and schistose rocks altered to potassium feldspar, quartz, albitized plagioclase, sericite, chlorite, and calcite. Vein systems occupy probable drag-induced faults and fissures caused by movements of the East Providence fault on the east side of the property. The large veins crop out for 250 to 1,350 ft and are 0.6 to 8.0 ft thick. Quartz is white to gray, massive to brecciated, iron-oxide stained and contains boxworks, limonite after pyrite, calcite, and rare galena.	Three adits, ranging from 8 to 175 ft with a 20-ft drift, three inclined shafts 10 to 40 ft deep, a flooded shaft, a caved shaft, two trenches, and 16 pits. Production from the Star mine was 7.26 oz gold and in 1898 and 9.67 oz gold in 1901 (USBM statistical files). Wright and others (1953) noted a small shipment in 1914-1915.	Thirty chip, 5 random chip, 6 grab, and 1 select sample taken. Of 16 with detectable gold, 5 contained a trace and 11 contained 0.01 to 0.06 oz/ton. Twenty-five samples with detectable silver were in the range of 0.052 to 3.2 oz/ton; 7 were >1 oz/ton. Of those analyzed, copper ranged from 0.0010% to 0.239%, lead ranged from 0.0021% to 0.67%, and zinc ranged from 0.0004% to 1.2%; only one exceeded 1% zinc. Molybdenum ranged from 0.0017% to 0.032% and 5 of 26 analyzed for tungsten contained 0.0006% to 0.0028%. Significant analytical values for gold, silver, copper, lead, and zinc, the size and number of veins, the alteration, and the rock type indicate this system should be studied in detail. In addition, the alteration, the proximity to felsic intrusive dikes and plugs, and anomalous analytical values of molybdenum describe an environment similar to the high-potassium, calc-alkaline molybdenum deposits of the stock, plutonic, or Climax type (Westra and Keith, 1981, p. 852).
39#**	SS No. 40 prospect.	A poorly exposed shear zone in quartz-rich gneiss is exposed in a 6-ft-deep pit. The zone is 8 ft thick, strikes N. 70° W. and dips 70° NE. Quartz stringers 1/2 to 1 in. thick extend into country rock from the shear zone. A 2-ft-thick quartz vein and a 3-ft-thick zone of iron-oxide stained schist are exposed.	One caved adit and two pits.	A chip sample across the 8-ft shear contained a trace gold and 0.04 oz/ton silver. The quartz vein contained 0.5 oz/ton silver and no gold. The iron-stained schist contained 0.006 oz/ton silver and no gold.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
40#**	SS No. 36 prospect.	A light pink, quartz-rich intrusive rock is partially altered to a soft punky material.	One pit.	A 3-ft chip sample contained 0.003 oz/ton silver.
41#	SS No. 38 prospect.	An adit trending S. 20° W. in weathered, well fractured biotite schist was probably intended to crosscut a 30- by 40- by 5-ft-thick massive white quartz outcrop 200 ft to the southwest.	One 20-ft adit.	One grab sample from the quartz pod contained 0.035 oz/ton silver; no gold detected.
42#*	SS No. 17 prospect, south.	A prominent outcrop, approximately 100 ft in diameter, contains three distinct composition and alteration zones. A 30- by 40-ft outcrop on the south consists of a network of massive, white, ring and radial quartz veins with minor molybdenite rosettes, fresh pyrite, boxwork structures, and cubic molds after pyrite containing residual sulfur. A lenticular 100 by 30 ft zone consists of subequal amounts of quartz and muscovite; grain size ranges from 1/32 to 1/4 in. The largest zone consists predominantly of quartz veins and breccia with approximately 25% sericite. Proton magnetometer surveys in the area show this outcrop to be near the center of a 200-300 gamma low indicating leaching of magnetite from the rock. The outcrop may be a breccia pipe.	One prospect pit on outcrop.	Five samples taken. Two random chip samples, one each of the quartz-muscovite and the quartz breccia with sericite, contained 0.0077% and 0.0050% molybdenum, 0.0010% and 0.0013% zinc, and 0.072% and 0.062% fluorine. A select sample from a radial vein contained 0.002 oz/ton gold, 0.0620% lead, 0.0250% molybdenum, 0.0006% tungsten and 0.024% fluorine, and a select sample from a ring vein contained 0.002 oz/ton gold, 0.0007% zinc, 0.0062% molybdenum and 0.010% fluorine. A select sample of quartz with molybdenite rosettes contained 0.0570% molybdenum. The sample values for molybdenum and fluorine, the alteration, and the geologic setting indicate the property merits additioal investigation to determine if molybdenum resources of the stock, plutonic, or Climax type (after Westra and Keith, 1981, p. 852) are present at depth.
43#**	SS No. 18 prospect, south.	A prominent, intensely silicified, altered outcrop as much as 17 ft thick strikes N. 75° E. and dips 65° NW. in gneiss. It appears to be intruded by a felsic dike containing quartz veins with some intergrown potassium feldspar; sericite and iron oxides were observed. The structure crops out for about 100 ft.	None.	Three chip samples across the outcrop; copper ranges from 0.0034% to 0.0170%, zinc ranges from 0.0043% to 0.0050%, and molybdenum ranges from 0.0011% to 0.0022%.
44#	Hoot Owl prospect.	A north-striking, vertical-dipping, gray to white quartz vein up to 2 ft thick (averages 1.2 ft) is exposed for 85 ft in a fault gouge as much as 5 ft thick. Country rock is a medium-grained granitic gneiss. No visible metallic minerals except minor disseminated pyrite. The vein is terminated on the north end by east-trending, north-dipping faults.	A 115-ft-long adit includes a 10-ft raise and a 16-ft-winze. Part of the adit was recently excavated to an open cut.	The vein contains an occurrence of about 500 tons at an average (weighted) value of 0.32 oz/ton gold. One grab sample and four chip samples taken. Three samples of the vein contained from 0.068 to 0.224 oz/ton gold and one contained 2.12 oz/ton gold. No gold was detected in the crosscutting faults. Based on the high gold values, the strength of structure, and the presence of other gold deposits in the vicinity, this zone should be studied in detail to determine if resources are present.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
45	Prospect.	A N. 60° E. striking, nearly vertical structure in granite gneiss bears comb quartz up to 6 in. thick with calcite filling. Disseminated pyrite occurs in quartz and in gouge.	One partially caved shaft and one trench.	Two grab samples contained 0.004 and 0.03 oz/ton gold, 0.274 and 3.1 oz/ton silver, 0.0022% and 0.0097% copper, and 0.021% to 0.16% zinc. One contained 0.016% lead and 0.0025% molybdenum. Gold and silver sample analyses indicate further study is warranted.
46	Triple 10 Nos. 1-3 prospect.	Massive to brecciated quartz veins 1 to 14 in. thick occur in sheared gneiss exhibiting chlorite and sericite alteration. One vein system strikes N. 55°-60° E., dips 50°-65° SE., crops out discontinuously for 500 ft and contains pyrite, limonite after pyrite, and abundant galena. A collapsed working 800 ft (along strike) from the southwestern outcrop may be on the same vein. An east-striking, 75° N. dipping shear zone is also developed.	One 20-ft adit, one caved adit or shaft and two inclined shafts, 20 and 25 ft deep.	Three chip and two select samples were taken. Of four samples taken on the quartz vein, two select samples contained 0.01 and 0.366 oz/ton gold, 2.5 and 8.4 oz/ton silver, 0.09% and 0.14% copper, 4.5% and 7.6% lead, and 0.28% and 0.88% zinc, two chip samples contained 0.006 and 0.032 oz/ton gold, 0.18% and 0.91% lead with one of the chips containing 0.9 oz/ton silver. The chip samples on the shear zone contained no detectable values. Sporadic moderate to high assay values of gold, silver, and lead indicate that the property merits further investigation.
47	Blue Jay No. 1 prospect.	East-trending shear zones in granite gneiss contain calcite veins with pyrite-filled fractures, massive gray to white quartz, and quartz breccia with silica cement; probable argentite at one isolated outcrop.	Two adits, 145 and 37 ft long, two flooded shafts, one 40 ft to water line, one 8 ft to water line, two pits, and a cabin.	Of 15 chip, grab, and select samples, 2 contained detectable gold at 0.01 oz/ton. Silver was detected in 11 samples, 9 contained 0.02 to 0.31 oz/ton and 1 select sample contained 21.1 oz/ton silver, 0.009% copper, 0.44% lead, and 0.03% zinc. Although sample analyses are generally low, the presence of detectable gold, one very significant silver value, and significant deposits of a similar nature to the northwest indicate the property merits additional investigation.
48	Decorative stone quarry.	Relatively flat-lying, punky to silicified, buff to gray, interbedded tuffs and rhyolitic lava flows underlie the property. Desired stone is apparently silicified tuff which splits into slabs 2 to 5 in. thick and about 12 in. in diameter.	One small quarry site and a network of exploration jeep trails. Possible production of less than 20 tons of decorative stone based on the size of the quarry.	No samples taken. Large tonnage available of stone marginally suitable as wall facade decorative stone. The deposit is classed as subeconomic except for local use due to the cost to ship to distant markets.
49**	Doddle Bug-Wildcat-Wild Horse placer prospects.	Fluvial sediments from washes in and entering Wild Horse Canyon are composed predominantly of gneissic, granitic, and volcanic silt, sand, and gravel (<1 in. in diameter) with 1%-2% black sands. Claims were located about 1960 in secs. 2 and 11, T. 11 N., R. 14 E. and in sec. 18, T. 11 N., R. 15 E. S.B.M.	None.	No gold was observed in two 0.38 ft^3 reconnaissance samples. One sample contained a trace garnet and a trace of native copper.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
50	Prospect.	A shaft was driven N. 50° E. to intersect a quartz vein which crops out to the east and 10 ft higher in elevation. The vein is 6 ft thick, strikes N. 50° W. and dips 78° NE. in a quartz-mica schist with quartz veinlets.	One 25-ft-deep inclined shaft.	One chip sample across the outcrop contained 0.01 oz/ton silver; no gold detected.
51**	Frisco No. 1 prospect.	Relatively unaltered to intensely altered, sulfide-bearing schist with no major structure observed. Altered schist contains magnetite, calcite, sericite, pyrite, and fine grained chalcopyrite. A 35-ft-thick rhyolite porphyry dike and sulfide ore, which contains 0.15 and 0.73 oz/ton gold, respectively, are reported (Tucker and Sampson, 1930, p. 235).	One caved adit was (Tucker and Sampson, 1930, p. 235) approximately 400 ft long with a 50-ft raise to the surface and a 30-ft winze.	Two grab samples from the approximately 1,000 yd^3 dump contained nil and 0.0006 oz/ton gold, 0.012 and 0.029 oz/ton silver, 0.015% and 0.040% copper, and 0.0037% and 0.0081% molybdenum. One contained 0.0049% zinc. Analytical results were low, however, the presence of other gold deposits in the vicinity, and reported grades, indicate that the property merits additional investigation.
52#*	SS No. 7 prospect.	A gray to white, iron-oxide stained, 1- to 3-ft-thick quartz vein which strikes N. 20° E., dips steeply southeast, and crops out for 50 ft.	None.	One random chip contained 0.0017 oz/ton gold, 0.15 oz/ton silver, 0.0720% lead, and 0.0020% molybdenum. Gold sample analysis and similar significant deposits in the vicinity indicate that further studies are warranted.
53	Prospect.	Localized, variably oriented, narrow quartz veins, 1-2 in. thick are in Precambrian gneiss. Veins are vuggy and iron-oxide stained. One vertical vein strikes N. 80° E.; one strikes N. 60° W., dips 54° SW.; and one strikes N. 20° E., dips 27° SE.	One 25-ft adit and two small pits. Workings are spatially related but apparently not structurally related.	Of three chip samples, one contained 0.077 oz/ton gold and two contained 0.3 oz/ton silver. One high gold value and the geologic environment indicate that the vein system merits further study.
54	Prospect.	A northwest-trending, steeply north-dipping fault zone is up to 5 ft thick, exposed for 115 ft, and has a 2- to 10-in. calcite vein in clay gouge; contains abundant pyrite in pods with spotty galena. A crosscut intersects three quartz-calcite veins and a 50-ft-wide zone of brecciated gneiss rock with disseminated pyrite. Two, localized, north-trending, steeply east dipping quartz veins and an east-trending, north-dipping shear zone are exposed on the surface. Veins and shear zones are in friable to punky, iron-oxide stained, banded granite gneiss.	One tunnel with one portal caved includes 115 ft of drift and 135 ft of crosscut; one open cut, 10 ft diameter.	Of 11 chip samples underground, 8 contained detectable gold ranging from 0.006 to 0.138 oz/ton, 8 contained detectable silver ranging from 0.4 to 12.3 oz/ton, 3 contained 0.1% copper, 7 contained 0.02% to 0.61% lead, and 8 contained 0.01% to 0.65% zinc. Six samples taken on the 115-ft calcite vein averaged 0.04 oz/ton gold and 4.7 oz/ton silver. No gold or silver were detected in three samples from veins and shear zones at the surface. The exposed deposit is too small for a resource calculation; however, the sporadic, moderately high assay values indicate the property merits additional study for gold and silver resources in veins.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
55**	Prospect.	Localized, 1- to 6-ft-thick northeast- to northwest-trending, easterly dipping, iron-oxide stained, sulfide-bearing quartz veins in fractured gneiss show sericitic and chloritic alteration. Quartz is white, massive to brecciated, and contains pyrite, limonite after pyrite, galena, and possibly chalcopyrite.	Three adits, 22 ft, 25 ft, and 128 ft long.	Of six chip and two grab samples, four contained from a trace to 0.08 oz/ton gold, six contained from 0.006 to 1.13 oz/ton silver, and from 0.0018% to 0.02% copper, and five contained from 0.0089% to 0.97% lead. Three samples analyzed for zinc contained 0.0029% to 0.033% and, of two samples analyzed for molybdenum, one contained 0.024%. Sample analyses and the size of the vein system indicate that further studies may reveal vein-type gold, silver, and possibly lead resources at depth.
56	Prospect.	An iron-oxide stained quartz vein, 0.3 to 0.5 ft thick, strikes N. 25° E. and dips 20° SE. in silicified granite gneiss.	One adit, 10 ft long.	One chip sample contained 0.0015 oz/ton gold, 0.296 oz/ton silver, 0.12% lead, 0.0034% molybdenum, and 0.042% bismuth. Significant nearby properties and the sample value suggest the prospect merits additional investigation.
57	Globe mine.	Roughly tabular, pinch and swell quartz veins and a zone of sheared and brecciated gneiss and quartz trend east and dip 30°-60° N. The zone is exposed for 240 ft along strike, 275 ft downdip and is about 5.0 ft thick. Nearby outcrops suggest a possible strike length of 1,500 ft. Quartz is white to dark blue-gray and contains pyrite, limonite after pyrite, galena, chalcopyrite, specularite, and probable sphalerite. Chlorite and epidote are common alteration minerals and hexahydrite encrustations have weathered out on the ribs in shear zones. Felsic volcanic rock exhibiting sericitic and chloritic alteration contains disseminated pyrite in two locations in the haulageway.	A 275-ft-long inclined shaft with 400 ft of drifts and 100 ft of stopes is connected by a 700-ft haulageway to a partially collapsed adit and shaft; three inclined shafts, a caved shaft, a 30-ft adit, and five pits. Tucker and Sampson (1930, 1931) reported very high-grade ore shipments.	Indicated subeconomic resources of 30,000 tons and inferred subeconomic resources of 80,000 tons at an average grade of 0.05 oz/ton gold and 1.0 oz/ton silver. Seventy chip, 3 random chip, and 2 select samples were taken. Fifty-one contained detectable gold, values ranged from a trace to 1.05 oz/ton; 12 contained $\geq$ 0.1 oz/ton gold. Fifty contained detectable silver, values ranged from 0.053 to 65.9 oz/ton; 16 exceeded 1.0 oz/ton silver. Thirty-eight contained 0.0008% to 0.0100% copper, 42 contained 0.0014% to 0.34% lead, 74 contained 0.0035% to 0.13% zinc, and 59 of 62 samples analyzed contained 0.0018% to 0.0330% molybdenum. Of 21 analyzed for tin and tungsten, 20 contained 0.02% to 0.04% tin and 9 contained 0.0006% to 0.0014% tungsten. Geologic setting, metal values, and similar deposits in the vicinity suggest additional gold, silver, and possible molybdenum resources may be present at depth.
58	Prospect.	A massive, 5- to 8-in.-thick, iron-oxide stained quartz vein strikes N. 3°-20° E. and dips 40°-80° NW. in silicified gneiss. Two outcrops of the vein are 140 ft apart. The vein is apparently terminated at both ends by east-trending, north-dipping shear zones.	One 30-ft-long open cut, one 10-ft adit with a 30-ft-long open cut and one adit, 40 ft long.	Two quartz vein chip samples contained 0.192 and 0.078 oz/ton gold and one contained 0.1 oz/ton silver. One random chip on a 20-ft-wide shear zone contained 0.010 oz/ton gold and 0.2 oz/ton silver. Sample analyses and a nearby past producer suggest the prospect merits further investigation for gold resources at depth.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
59	Prospect.	An east-striking, 40°-50° N. dipping quartz-bearing shear zone and a quartz vein occur in a fault gouge zone 4.5 ft thick, striking N. 80° W. and dipping 55° SW.; both are in altered, Precambrian gneiss.	Two shallow pits.	One select grab on the quartz-bearing shear contained 0.074 oz/ton gold and 0.8 oz/ton silver. One chip sample from the quartz vein contained 0.01 oz/ton gold and 0.01% lead and zinc. No copper detected. Based on gold and silver assay values and similar deposits in area, the property merits additional investigation.
60	Prospect.	A north-northwest trending, steeply northeast-dipping, pinch and swell quartz vein up to 12 ft thick is poorly exposed in granite gneiss country rock which is silicified and sericitically altered. Some pyrite and considerable manganese oxides observed. Some secondary copper minerals are on fractures.	One adit, 15 ft long, one caved shaft, and one trench.	Four of five chip and grab samples contained detectable gold and all contained detectable silver; gold assays ranged from 0.002 to 0.01 oz/ton and silver assays ranged from 0.09 to 3.4 oz/ton. One sample contained 1.3% copper with the rest ranging from 0.0012% to 0.04%; minor lead and zinc were also detected. Two samples contained 0.0011% and 0.0056% molybdenum. Sample analyses for gold and silver, prominance of vein, and similar nearby deposits indicate the property merits additional investigation for small, high-grade, vein-type gold and silver resources.
61	Prospect.	Small quartz lenses occur in iron-oxide stained, fractured banded gneiss.	One pit.	One grab sample contained 0.006 oz/ton gold, 0.14 oz/ton silver, 0.0031% zinc, and 0.0021% molybdenum. The presence of anomalous gold and nearby past producers indicate that additional studies are warranted.
62	Clamento No. 3 prospect.	West-northwest-striking, variably dipping white to gray quartz veins in argillically to sericitically altered, punky to silicified gneiss along a northern projection of the East Providence fault zone. The quartz is 1 ft thick, iron-oxide stained, and in some places contains secondary copper minerals.	One inclined shaft, 30 ft deep, one adit 7 ft long, and three pits.	Three chip and three grab samples taken. All samples contained detectable gold and silver; silver ranged from 0.012 to 0.872 oz/ton and gold ranged from 0.0006 to 0.085 oz/ton. Two gold assays were greater than 0.01 oz/ton; at 0.085 and 0.077 oz/ton. One sample contained 1.9% lead and one contained 1.9% copper. Other sample values ranged from nil to 0.031% copper, nil to 0.058% lead, and 0.0030% to 0.079% zinc. Four samples contained from 0.0008% to 0.0048% molybdenum. Consistent gold values and nearby past producers suggest that additional exploration for gold and silver resources with byproduct copper and lead resources is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
63	Prospect.	Generally northwest-trending, northeast-dipping, white to translucent gray, iron-oxide stained, 1 to 6 ft thick quartz veins are associated with shear zones in gneiss. Quartz is massive to brecciated with a few voids formed by dissolved pyrite.	Two short adits, one 20-ft-deep inclined shaft and three pits.	Four of nine chip samples contained measurable gold, from 0.002 to 0.085 oz/ton. Eight of nine samples contained measurable silver, from 0.05 to 2.7 oz/ton. Only one of the silver assays was above 1 oz/ton. Low levels of copper (≤ 0.03%), lead (≤ 0.17%) and zinc (< 0.05%) were detected in some samples. Molybdenum ranged from 0.003% to 0.0075% in five samples. Sample analyses and nearby gold and silver deposits indicate that the property merits additional study.
64	Frisco No. 3 mine.	Two quartz veins have the following strikes and dips: the Horn Silver, N. 10°-30° W., 25°-42° NE., and the Silver Bell, N. 50°-70° W., 45°-75° NE. The veins are in locally intensely altered, silicified gneiss. Quartz is white to gray, iron-oxide stained and massive to brecciated with rare comb structures. Altered rock is composed of quartz, potassium feldspar, sericite, jarosite, and iron oxides. The Horn Silver vein is exposed for 55 ft and is up to 20 ft thick. The Silver Bell vein is exposed for 500 ft and is 1- to 5.5-ft thick.	Five adits (5, 15, 35, 84, and 235 ft long), two shallow inclined shafts, a caved inclined shaft, two pits, and several open cuts. Production from 1 ton of ore was 2.11 oz gold and 54 oz silver in 1930 (USBM statistical files).	The Silver Bell vein contains an indicated subeconomic resource of 2,000 tons at 0.006 oz/ton gold and 0.2 oz/ ton silver and an inferred subeconomic resource of 38,000 tons averaging 0.022 oz/ton gold and 0.7 oz/ton silver. One grab, 4 random chip, and 25 chip samples taken. Fifteen of 20 samples on the Silver Bell vein contained 0.001 to 0.07 oz/ton gold and 0.04 to 6.0 oz/ton silver. Seven of 9 samples on the Hornsilver vein contained 0.020 to 0.196 oz/ton gold and 0.3 to 11.8 oz/ton silver. Generally low levels (≤ 0.01%) of copper, lead, zinc, and molybdenum were detected in samples from the two vein systems although lead ranged from 0.12% to 0.28% in eight samples and one contained 1.2%. Size, grade, and alteration indicate this property merits further investigation for additional gold and silver resources with possible byproduct lead.
65	Prospect.	A west-northwest-trending, northeast-dipping, fault zone contains gray to white, massive to brecciated quartz veins and iron-oxide stained fault gouge and breccia. Country rock is silicified Precambrian gneiss. The main structure is 2 to 5 ft thick and crops out for approximately 80 ft.	Two shafts, 16 and 17 ft, and one adit, 8 ft long.	Of four chip samples, two had 0.006 and 0.038 oz/ton gold and 0.4 oz/ton silver. Three contained 0.01% to 0.2% lead, and four contained 0.01% to 0.04% zinc; no copper detected. Higher values occur in the central part of the outcrop. Sample analyses, size of the vein, and nearby deposits indicate that the property merits further study for gold and possibly silver resources at depth.
66	Prospect.	A 2-ft-thick shear zone strikes N. 22° E., dips 65° SE., contains quartz veins, and occurs in Precambrian granite gneiss. The zone is highly fractured with iron-oxide filling and purple-brown alteration products in the fractures and joints.	One pit.	One chip sample had 1.29 oz/ton gold, 6.9 oz/ton silver, 0.17% lead, and 0.03% zinc. The high gold and silver assay value indicates that further study is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
67	SS Nos. 51, 52, 60, and 61 prospect.	A discontinuous, northeast-trending, vertical- to northwest-dipping, white, 1- to 5-ft-thick quartz vein, and a pegmatite dike occur in gneiss. Quartz and the enclosing shear zone contain pyrite, limonite after pyrite, galena, and calcite. The system is exposed for about 120 ft.	One flooded shaft, two adits, 140 ft and 65 ft long, and six pits.	Eleven chip samples contained 0.01% to 0.03% copper and 0.01% to 2.8% lead; only one sample exceeded 0.5% lead. No gold or silver were detected. Extent of workings and the high lead assay value indicate that further study is needed.
68	Prospect.	Minor amounts of iron-oxide stained, vuggy quartz occur in 4- to 12-ft-thick, variably oriented, bleached, silicified gouge and shear zones in altered gneiss. The main structure strikes N. 15°-20° W. with a near vertical dip.	Two adits, 8 and 15 ft long, one 20-ft trench and one pit.	Of five chip samples, three contained from 0.001 to 0.05 oz/ton gold. Silver values ranged from 0.04 to 0.9 oz/ton. Gold and silver sample analyses indicate that additional study is needed.
69	Double H Nos. 1 and 2 mine.	A quartz vein and a silicified, altered shear zone strike N. 50°-60° W., dip 45°-75° NE., and crop out for approximately 1,000 ft in gneissic rock. The vein averages 1.4 ft thick, is white to gray and contains pyrite, galena, and sphalerite.	Two pits, a 50-ft-long open cut, two adits (45 ft and 90 ft long), one caved adit, and one inclined shaft at least 40 ft deep. Production from 105 tons of ore was 42 oz gold and 329 lb copper in 1931 (USBM statistical files).	An inferred subeconomic resource of 45,000 tons at an average grade of 0.02 oz/ton gold and 2.5 oz/ton silver with byproduct lead and zinc. The past production, the size of the deposit and the sample analyses suggest further investigation may reveal additional vein-type gold and silver with byproduct copper, lead, and zinc resources at depth. Eight chip and three select samples; nine contained gold which ranged from 0.006 to 0.268 oz/ton and averaged 0.063 oz/ton; silver ranged from 0.5 to 44.4 oz/ton and averaged 8.2 oz/ton, only four exceeded 5 oz/ton silver. Lead and zinc ranged from 0.01% to 1.2% and 0.02% to 0.3% and averaged 0.2% and 0.07%, respectively. The past production, the size of the deposit, and the sample values suggest that further investigation may reveal additional vein-type gold and silver resources with by-product copper, lead, and zinc.
70	Santa Anita-Beecher Canyon placer prospects.	Fluvial sediments from the head and mouth of Beecher Canyon are composed predominantly of gneissic sand and pebbles with slight to moderate quantities of volcanic rock. Two samples had notable comb quartz fragments. One claim was located in 1916 at the mouth of the canyon, and two claims were located in 1961 at head of the canyon.	None.	Of four 0.38 ft^3 reconnaissance pan samples of typical sediments and one select 0.38 ft^3 pan sample of surficial concentrations of black sands, three samples contained gold. Two of the reconnasisance samples at the head of the canyon contained 0.022 and 0.023 mg of bright, subrounded gold with traces of pyrite, scheelite, and zircon. The select sample at the mouth of the canyon contained 0.169 mg of bright, subangular to subrounded gold with a trace of garnet. Value of the three samples is estimated to range from $0.02 to $0.15/$yd^3$ at a gold price of $400/oz.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
71	Orro Platta prospect.	Quartz veining 1 to 4 ft thick occurs along predominantly northwest-trending, northeast-dipping fault zones. Country rock is Precambrian gneiss with argillic (?) alteration and scattered iron-oxide staining. The quartz vein is exposed in workings for 450 ft along its northwest trend, but continuity of the structure is uncertain between workings.	One shaft, 18 ft deep, three adits, two 10 ft long and one 50 ft long, and one pit.	Of seven chip samples from quartz veins and gouge, six had no gold and one had 0.186 oz/ton gold and 11.7 oz/ton silver. Three samples had 0.2 to 0.5 oz/ton silver and one had 1.1 oz/ton silver. One sample contained 0.05% copper, six contained 0.01% to 0.08% lead, one contained 0.52% lead, and zinc values ranged from 0.01% to 0.08%. Sporadic but significant sample values, and past producers in the vicinity, indicate that the vein system should be studied in detail to determine whether or not gold, silver, and possibly lead resources are present.
72	Providence mine.	Two north-northeast trending faults bound a 30-ft-thick zone of silver-bearing, limestone breccia, near a contact with gneiss. The East Providence fault gouge averages 5.5 ft thick and contains gold. The deposit is exposed for 80 to 130 ft but the fault contact and limestone breccia continues at least 3 mi south.	A 224-ft adit, two adits, and two shafts, one collapsed at collar. Leech (1890, p. 105) reported 4.1 oz gold produced in 1889 and USBM statistical files report 12 tons containing 445 oz silver, 166 lb copper, and 2,465 lb lead produced in 1918.	Of 15 chip and 2 random chip samples, 3 contained 0.01 to 0.11 oz/ton gold and 4 contained 0.3 to 1.0 oz/ton silver. Four samples contained 0.01% to 0.06% lead. Past production, the similarity of this deposit to the Silver King mine (no. 149), and the sample analyses indicate that the property merits further investigation for additional silver, gold, lead, and copper resources at depth or laterally along the brecciated limestone.
73	SS Nos. 63, 64 prospect.	Workings are on two sets of structures in Precambrian gneiss and Paleozoic limestone with local exposures of granitic rock. One set strikes N. 50°-65° E. with dips ranging from 50° NW. to 45° SE. and the other set strikes N. 20°-30° W. and dips 45°-50° NE. Structures range from 0.5 to 9.0 ft thick.	Three adits, 5 ft, 32 ft, and one caved; four inclined shafts 11 ft, 25 ft, at least 50 ft, and 50 ft with 50 ft of drift.	Of nine chip samples, four contained 0.2 to 0.5 oz/ton silver; none contained gold. Extent of workings, nearby deposits, and sample analyses indicate that the property merits additional investigation; silver resources may be associated with shear zones in carbonate rocks.
74	Prospect.	Localized, variably oriented quartz veins and silicified zones 2 to 6 ft thick occur in light green, coarse, crystalline rock intruded by rhyodacite dikes and/or sills. The crystalline rock exhibits sericitic alteration. Veins strike north, northeast, and east and dip north or east.	One adit, 15 ft long, and three pits.	Of four chip samples, one contained a trace gold, two contained 0.1 to 0.2 oz/ton silver, two contained 0.003% to 0.0069% copper and four contained from 0.0038% to 0.0054% molybdenum.
75	Terry placer prospect.	Fluvial sediments from Globe Canyon are composed of gneissic pea gravel and 2% black sands. Wash commonly has only a thin veneer of alluvium over bedrock. Claim located in 1930.	One pit to bedrock. An attempted sluicing operation apparently failed.	One 0.38 ft^3 reconnaissance pan sample contained four bright, subangular to subrounded, chunky fragments of gold for a total of 0.020 mg. Value is estimated at \$0.02/yd^3 at a gold price of \$400/oz.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
76	Prospect.	Multiple, white, iron-oxide stained quartz veins totaling 0.7 ft thick occur in a fault gouge zone striking N. 70° E. and dipping 65° NW. in gneiss exhibiting sericite and chlorite alteration. Quartz contains fresh galena, limonite after pyrite, secondary copper minerals, and manganese-oxide crusts.	One inclined shaft 10 ft deep.	One chip sample contained 0.017 oz/ton gold and 0.36 oz/ton silver, 0.041% copper, 0.84% lead, 0.0045% zinc, and 0.0077% molybdenum. Sample analysis indicates that further investigation for gold and possibly silver and lead is warranted.
77#	Okaw mine.	Country rock is quartz monzonite intruded by rhyolitic dikes. Both the monzonite and the dikes exhibit sericitic alteration. Northeast-striking quartz veins, 0.6 to 3.7 ft thick, dip steeply to the south and contain galena, limonite after pyrite, and minor amounts of chalcopyrite, sphalerite, and secondary copper minerals. Veins and shears are exposed for at least 400 ft.	Five shafts, all inaccessible, 3 adits, 24, 30, and 105 ft long, and 8 pits. Building foundations appear to be from a mill. No known production.	Of 16 chip, 3 select, and 2 grab samples, 17 contained measurable gold and silver. Eleven samples had gold values between 0.01 and 0.29 oz/ton and 7 samples had silver values between 1.0 and 6.1 oz/ton. All samples contained detectable lead; 8 contained from 1.2% to 7.8%. Copper values ranged from 0.0009% to 0.83% and molybdenum values ranged from 0.0018% to 0.027% in 15 samples analyzed. The number and sizes of veins and the high analytical values for gold, silver, lead, and copper indicate further exploration is warranted.
78	Prospect.	Three segments (52 ft, 72 ft, and 180 ft) of a northwest-trending, variably dipping 6- to 10-ft-thick, white quartz vein crop out for a strike length of 440 ft in granitic rock.	One pit.	One grab sample contained 99.15% SiO_2, 0.30% iron, and 0.05% Al_2O_3. No gold or silver was detected. Inferred size of the occurrence is 9,900 tons. Silica grade meets specifications for some industrial applications, however, small deposit size and great distance to market suggest little, if any, economic significance for the foreseeable future.
79**	Prospect.	An altered zone in quartz monzonite is exposed in two pits 50 ft apart. The zone of alteration is 8 ft thick as exposed in the face of one pit. A portion of the zone about 3 ft thick is leached and bleached to a punky white clay and contains quartz ribs 2 in. to 4 in. thick.	Two pits.	A sample from the 3-ft section contained trace gold and 0.06 oz/ton silver. Additional investigation is merited.
80	Prospect.	A contact of quartz monzonite and gneiss is exposed for 10 ft. The contact strikes N. 80° E. and dips south at 40°. A fractured and silicified zone 6 ft thick occurs in the quartz monzonite at the adit portal. The zone contains minor pyrite and copper carbonate.	One 10-ft adit.	A 3-ft chip sample contained 0.01 oz/ton gold and 0.17 oz/ton silver. The gold value indicates that the prospect should be investigated in more detail.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
81	Prospect.	Shaft symbol on provisional (1983) U.S. Geological Survey Hayden 7.5 minute quadrangle. Granitic terrain; may be an extension of the Prospect (no. 78). Prospect not found during field studies.	One shaft (?).	Property not examined.
82	Prospect.	Lenses and stringers of specular hematite occur in pinkish, medium-grained, quartz-rich intrusive rock, probably quartz monzonite. A pit in weathered gneiss is located S. 80° E., 100 ft from the center of a bulldozer cut. Stringers of hematite up to 1 in. thick can be traced 400 ft south from the bulldozer cut and 100 ft to the north. The maximum thickness of lenses exposed in a cut is 2 ft. The ore mineral is massive, specular hematite with a minor amount of pyrite.	One 50-ft-long bulldozer cut and one pit.	A grab sample from a 4 ton stockpile contained 41.5% iron and 0.05 oz/ton silver.
83	Del No. 2 prospect, north extension.	A fractured, iron-oxide stained, 5-ft-thick zone strikes N. 85° W. and dips 45° NE. along an irregular contact zone between gneiss and granitic rock.	Open cut, 10 ft deep.	One chip sample contained no detectable gold or silver.
84	Prospect.	An iron-oxide stained 25-ft-thick contact zone is between gneiss and a rhyolite dike.	One 3-ft adit and a 32-ft trench.	One chip sample contained 0.009 oz/ton silver.
85	Prospect.	A 2-ft-thick, N. 80° W. striking, vertical, silicified, iron-oxide stained zone occurs along a dike in foliated schist.	One pit.	One chip sample contained 0.3 oz/ton silver; no gold detected.
86	Del No. 2 prospect.	A 600-ft-long, relatively flat-lying, weak skarn zone occurs along a contact between a fine-grained gray rock (limestone?) and granitic rocks.	One 62-ft adit, three shallow shafts, and four pits.	One chip and one select sample contained 0.009 and 0.006 oz/ton silver. No gold was detected.
87	Firefly-White Eagle-Star placer prospects.	Fluvial sediments from Summit Wash are composed of poorly sorted, gneissic sands, gravels, and cobbles. Wash is narrow and moderately scoured at upper elevations and rapidly widens and thickens at confluence with Globe Wash. Claims located 1913-1938.	None.	Of three 0.38 ft^3 reconnaissance pan samples, one contained 10 bright, subrounded-to-subangular pitted, chunky fragments of gold, for a total of 0.110 mg, and traces of garnet and hematite. Value is estimated at $0.10/$yd^3$ at a gold price of $400/oz. Two samples contained traces of scheelite.
88	SS No. 49 prospect.	A 5-ft-thick, vuggy, iron-oxide stained, pyrite-bearing quartz zone trends N. 40° W. in green to white, fine-grained intrusive rock.	Open cut 8 ft long.	One chip sample contained 0.0014% molybdenum and 0.0018% tungsten; no gold or silver was detected.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
89	Del No. 2 prospect, south extension.	A 2-ft-thick breccia zone strikes N. 30° E. and dips 80° NW. along a contact zone between gneiss and granitic rock. The zone contains 1/4- to 1/2-in.-thick quartz veinlets, minor secondary copper minerals, and some garnet and epidote.	One pit.	One chip sample contained 0.01 oz/ton silver; no gold detected.
90	Prospect.	Pits are in a N. 30° W. striking, 64° NE. dipping, fracture zone in a light gray, fine-grained rhyolitic rock. Zone is observed for 25 ft along strike and is 3.5 ft thick.	Two shallow pits.	One chip sample contained 0.007 oz/ton gold. Sample analysis indicates the prospect warrants further study.
91	Prospect.	A thin, irregular, altered contact zone occurs between weathered gneiss and a light colored, quartz-rich intrusive rock. The 1.5-ft-thick, iron-oxide stained contact zone trends N. 45° E., dips vertical and is altered to clay.	Two pits.	One chip sample contained no detectable gold or silver.
92	Prospect.	Light gray to tan, fine-grained, silicified rock, probably rhyolite, is iron-oxide stained, contains up to 5% fine, crystalline pyrite, and knife-edge to 1/4-in.-thick veinlets and blebs of specular hematite. A nearby pit is in brecciated, silicified limestone cemented with massive white calcite. The breccia contains irregular stringers of specular hematite.	One 24-ft-deep inaccessible shaft, and one pit.	A grab sample of rhyolite contained 0.006 oz/ton gold and 0.006 oz/ton silver. A grab sample of limestone contained 0.55 oz/ton gold and 0.06 oz/ton silver. Although the geologic environment is not well understood at this prospect, the gold sample analyses suggest that the prospect merits additional investigation.
93	Silver Queen I-XXXIII prospect.	Several quartz veins generally trend northeast, dip steeply southeast, and crop out in granitic country rock. The veins are 0.5 to 1.0 ft thick and contain galena, pyrite, and chalcopyrite. Minor amounts of secondary copper minerals and iron oxides are also present. The veins pinch and swell and can be traced up to 200 ft. One vein, exposed in a pit, is cut off by a fault or shear zone just below the surface.	Three shallow shafts, three trenches, and one pit.	A total of five samples were taken, four of which were from quartz veins. Two of the four quartz vein samples contained 0.19 and 0.37 oz/ton gold, 2.2 and 4.7 oz/ton silver, and 4.2% and 1.8% lead. The exposed veins are too narrow and discontinuous to make a resource estimate, but the high values of gold, silver, and lead warrant further exploration.
94**	First Chance placer prospect.	Fluvial sediments consist of 90% pea gravel and coarse sands and 10% silt and clay; composition is predominantly granitic and contained 1%-3% black sands. The First Chance claims were located in secs. 9, 16, and 23, T. 11 N., R. 13 E., S.B.M., in 1954 and 1957.	None.	One 0.38 ft^3 reconnaissance pan sample contained two particles of bright, subangular to angular gold for a total of 0.001 mg. The material is valued at less than $0.01/$yd^3$ at a gold value of $400/oz.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
95**	Prospect.	Three- to 7-ft-thick silicified and altered zones trend north, dip steeply east, and crop out discontinuously for approximately 400 ft in gneiss and quartz monzonite. Numerous quartz veinlets merge into massive gray quartz with minor amounts of specular hematite.	One 38-ft adit and three pits.	Four samples contained no gold or silver and only minor amounts of copper, lead, and zinc.
96#**	Jo Je mine.	Two subparallel quartz veins 500 ft apart trend west-northwest and dip south in granitic rock. The veins are 1 to 3 ft thick, crop out for 700 to 900 ft, and contain white to gray, massive to brecciated, iron-oxide stained quartz with limonite after pyrite and rare galena. An andesite dike lies adjacent to the south vein. Northwest-trending, northeast-dipping normal faults cut the north vein.	Workings consist of six shafts, 15 to 90 ft deep, two trenches and nine pits. The main shaft may have 300 ft of drifts on two levels. USBM statistical files indicate 185 tons of crude ore contained 72 oz gold and 392 oz silver (grades averaged 0.39 oz/ton gold and 2.1 oz/ton silver) from a small cyanide mill.	Of 1 select and 15 chip samples, 8 contained gold ranging from 0.012 to 0.163 oz/ton and averaging 0.052 oz/ton, and 6 contained silver ranging from 0.3 to 2.1 oz/ton and averaging 0.9 oz/ton. Copper values ranged from 0.0091% to 0.06%, lead values ranged from 0.03% to 0.53%, and zinc values ranged from 0.0013% to 0.01%. Production history and sporadic but significant gold and silver values indicate this property may have additional high-grade, vein-type resources at depth.
97	Morning Star prospect.	A quartz vein 3 in. thick occurs in granitic rock and contains pyrite and limonite pseudomorphs after pyrite.	One adit (caved).	One grab sample contained 0.0009 oz/ton gold and 0.02 oz/ton silver, 0.0046% zinc and 0.0056% molybdenum; no copper or lead detected. Presence of gold suggests further exploration is warranted.
98	Prospect.	A 0.5-ft-thick quartz vein with stringers of remnant sulfides strikes N. 30° E. and dips 32° SE. in granitic country rock. Chloritic alteration occurs along the contacts and stringers of hematite occur within the country rock.	One pit.	One chip sample contained 0.01 oz/ton gold, 0.0020% copper, 0.0400% lead, and 0.0044% molybdenum. Alteration and sample analysis indicate that the prospect merits additional investigation for gold resources.
99	Green Scorpion prospect.	A fault zone trends northeast and dips northwest in metaigneous rock and contains a quartz vein, quartz breccia, and soft gouge. The vein contains relict sulfides, secondary copper minerals, and iron- and manganese-oxide staining. Extensively silicified, carbonatized, and sericitized porphyritic dikes of andesite to rhyodacite composition are exposed in the workings and cut by the mineralized fault. The fault zone is exposed discontinuously for 185 ft along strike and averages 2.3 ft thick.	One 55-ft-long adit and one pit.	The deposit contains 3,300 tons with a weighted average grade of 0.086 oz/ton gold. Four chip and one select sample were taken. Gold assay values ranged from 0.0005 to 0.16 oz/ton, and averaged 0.1 oz/ton, and silver assay values ranged from 0.04 to 0.3 oz/ton. Copper content ranged from 0.012% to 0.17%, two samples contained 0.0047% and 0.0062% molybdenum, and one sample contained 0.0039% zinc. Several high gold assay values indicate the property merits additional investigation.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
100	Independence prospect.	Coarse-grained granite gneiss is brecciated locally, with sericitic and kaolinitic alteration and some iron-oxide staining.	One bulldozer cut and one pit.	One sample contained 0.0170% zinc and 0.0048% molybdenum; no gold, silver, copper, or lead detected.
101	Greek prospect.	Two intersecting shears in porphyritic rhyolite exhibiting sericitic alteration. Gouge along structures is iron-oxide stained and 2 in. thick.	Two pits.	One sample contained 0.5 oz/ton silver and 0.0054% molybdenum; no copper, lead, or zinc detected. Silver sample analysis and the nature of nearby deposits indicate further study is warranted.
102	Fan 1-5 prospect.	Granitic intrusive rock and granite gneiss is intruded by dikes of andesitic to dacitic composition. Several fault or shear zones containing quartz veins, breccias, and gouge trend northwest and northeast and dip northerly. Minor occurrences of secondary copper minerals and primary sulfides are within the 1- to 5.5-ft-thick veins. The bleached country rock exhibits chloritic alteration. One vein is exposed for 200 ft and a shear zone is exposed for 400 ft along a northwest strike.	Five adits (125, 75, 60, 38, and 37 ft long) and 10 pits. One adit has a flooded winze (depth unknown) and another has a 25-ft stope to the surface.	A total of 26 chip samples were taken. Of 16 which contained detectable gold, 8 contained from 0.021 to 1.059 oz/ton and 8 contained from 0.0003 to 0.007 oz/ ton gold. Of 19 which contained detectable silver, 4 contained from 1.1 to 33.6 oz/ton and the remainder ranged from 0.003 to 0.936 oz/ton silver. Three of 9 samples with detectable lead contained from 0.29% to 2.6%; the remainder ranged from 0.0170% to 0.055% lead. Six contained low levels of copper (<0.02%), 10 contained low levels of zinc (<0.083%), and 8 contained low levels of molybdenum (0.0006% to 0.0022%). The few, sporadic, high-grade samples, the size of the structures, and the geologic setting indicate further sampling and exploration for gold and silver resources with byproduct lead are warranted.
103**	Prospect.	Granite gneiss contains specular hematite which occurs along fractures striking N. 15° W. and dipping 85° NE.	One pit.	One select sample: no gold or silver detected.
104	Pink Jack prospect.	Granite gneiss is intruded by west-northwest-trending, south-dipping pegmatite and andesite dikes. The country rock adjacent to the dikes exhibits intense alteration; shearing occurs along the country rock and dike contacts. Sulfides are rare but relict sulfide textures and boxwork structures are common along with iron oxides; minor secondary copper minerals in pegmatite dikes. Mineralized zones are 1 to to 6.5 ft thick.	Two adits, 220- and 5-ft-long; one shaft, about 50 ft deep; and four pits.	Fifteen chip samples were taken. Thirteen of the samples contained detectable gold ranging from 0.0006 to 0.56 oz/ton. Nine of these samples contained greater than 0.03 oz/ton gold and had a weighted average of 0.157 oz/ton. All samples analyzed contained values ranging from 0.0009 to 0.093 oz/ton silver, 0.0006% to 0.266% copper, 0.0031% to 0.089% lead, and 0.0023% to 0.021% zinc. Significant gold assay values coupled with proximity to other properties with high gold values indicate further exploration is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
105**	Prospect.	Numerous, localized shear and silicified zones, 0.3 to 2.2 ft thick, some containing quartz veins, occur in granitic to gneissic country rock. General trend of the structures is east to east-northeast with variable dips. Metallic minerals in veins include galena, chalcopyrite, pyrite, and secondary copper minerals.	Two adits, 25 and 17 ft long; one shaft, 10 ft deep; three pits.	One of five chip samples contained 0.25 oz/ton gold and 1.5 oz/ton silver along with 0.66% copper, 11.9% lead, and 0.0045% zinc. The four remaining samples contained 0.003, 0.004, 0.037, and 0.048 oz/ton gold with silver ranging from 0.020 to 0.41 oz/ton, copper ranging from 0.0087% to 0.0170%, lead ranging from 0.077% to 0.239%, and zinc ranging from 0.0023% to 0.0075%. High gold, silver, and lead values, the presence of anomalous copper, and similar properties in the area indicate that the property merits additional investigation.
106	Prospect.	Quartz veins, in or near a west-northwest-trending, northeast-dipping fault (?) contact between quartzite and gneiss are iron-oxide stained and commonly contain limonite pseudomorphs after pyrite. Veins are 1 to 3.5 ft thick.	Two pits and one 10-ft incline.	Of three chip samples, two contained 0.002 oz/ton gold. Three contained from 0.002 to 0.122 oz/ton silver, 0.0011% to 0.0067% copper, 0.0045% to 0.0074% lead, and 0.0086% to 0.062% zinc. Gold sample analyses indicate further study is warranted.
107*	Prospect.	At the incline, two parallel quartz veins 3.0 ft thick, striking N. 75° W. and dipping 60° SW. can be traced for about 50 ft in granitic country rock. The veins contain chalcopyrite, chrysocolla, and limonite after pyrite. Both veins are truncated by a fault just below the ground surface. The country rock shows chloritic alteration near the veins. At the adit, two 4-ft-thick shear zones intersect in gneissic country rock.	One 15-ft-deep incline and one 6-ft-long adit.	One chip sample taken across the two veins contained 0.240 oz/ton gold and 0.245 oz/ton silver, 0.379% copper, 1.2% lead, and 0.060% zinc. A second chip sample contained 0.0026 oz/ton gold, 0.032 oz/ton silver, 0.0018% copper, 0.050% lead, and 0.0095% zinc. Sample analyses of gold, silver, lead, and possibly copper suggest further investigation is needed.
108*	L'Chacana prospect.	A 1- to 4.5-ft-thick quartz vein crops out along a north-trending ridge of granite gneiss country rock for about 800 ft. The vein contains minor amounts of secondary copper minerals. About 150 ft to the east a stockpile (?) of quartz vein material contained some galena along with secondary copper minerals. The end of the shaft dump contains pegmatite with a brecciated matrix displaying disseminated pyrite and sericitic and argillic alteration. A shallow intrusive contact is indicated.	One 100-ft-deep inclined shaft, one caved adit, two pits, and one trench.	Of 10 chip and 4 grab samples taken, 1 grab sample contained 0.046 oz/ton gold and 0.577 oz/ton silver, 5.8% lead, 0.171% copper, and 0.289% zinc. Another grab sample contained 0.0178 oz/ton gold, 0.0467 oz/ton silver, 0.0007% copper, and 0.0023% lead. Of seven chip samples on the main vein, six contained from 0.0026 to 0.007 oz/ton gold along with minor silver, copper, lead, and zinc. Geologic environment and sample analyses suggest that the property should be studied in detail to determine if vein or disseminated gold resources with byproduct lead, silver, zinc, and possibly copper are present at depth.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
109**	Prospect.	Two subparallel shear zones strike N. 25° to 40° E., dip 42° to 85° NW. and form a zone 2 to 3 ft thick in granite gneiss.	One 16-ft adit.	One chip sample contained 0.0003% copper and 0.0016% lead; no gold or silver detected.
110	Prospect.	Granite gneiss near a contact with quartzite contains numerous northwest-trending shear zones, a N. 70° E. striking, 50° SE. dipping quartz vein, and a northwest-trending porphyritic andesite dike. Secondary copper minerals occur along fracture surfaces in the shear zones and the 0.7-ft-thick quartz vein contains numerous iron-oxide filled, boxwork structures.	Eight pits and one trench.	Of seven chip and one grab sample, seven contained 0.0008 to 0.042 oz/ton gold, six contained 0.006 to 0.068 oz/ton silver, and minor copper, lead, and zinc were detected. Contact environment and gold sample analysis indicate that further studies are warranted.
111	Prospect.	Fault gouge zones occur between gneissic rock to the northwest and metasediments to the southeast. The fault zone trends north-northeast and is 18 ft wide.	Two adits (25 and 48 ft long).	Three of four chip samples contained 0.1 to 0.3 oz/ton silver; copper ranged from 0.0004% to 0.0012%, lead was constant at 0.0023% and zinc ranged from 0.0047% to 0.0072%.
112#	Tough Nut mine.	Upper workings are in carbonate rocks and one lower working is in shale and quartzite. Mineralized zones occur as irregular, 1- to 6-ft-thick replacement pods and lenses predominantly in carbonates. The main zone is along an east-trending, south-dipping fault that offsets shale and quartzite. Gangue is calcite with possible barite. Minor pyrite and pyrrhotite occur in the lower working. Possible lead sulfates or carbonates are in the mineralized zones. The mineral assemblage is very similar to those at the Silver King (Perserverance) and Bonanza King mines (pl. 1, nos. 144 and 146).	The lower working is a 360-ft adit with two drifts. The upper workings consist of three adits totaling 46 ft, four inclined shafts with stopes totaling at least 300 ft, and nine prospect pits. No production recorded; however, some production indicated by: 1) stopes, 2) high grade samples, 3) old millsite, and 4) similarity of geology to nearby past producers to the east.	Of 30 chip, 4 random chip, and 2 grab samples taken, most of the 26 samples from workings in carbonate rock contained detectable gold and silver. Values ranged from 0.0012 to 2.01 oz/ton gold and 0.012 to 67.2 oz/ton silver. Three samples had more than 0.1 oz/ton gold and five samples had more than 1.0 oz/ton silver. Lead values ranged from 0.003% to 2.9%; zinc ranged from 0.0005% to 0.49%; and copper ranged from 0.001% to 0.035%. The exposed mineralized structures are largely mined out; however, the probable past production, the sporadic but high assay values, and the similarity of geology to significant past producers to the east suggest the property merits further investigation for gold, silver, lead, and possibly, zinc resources at depth.
113	Lopez No. 1 prospect.	The 4- to 10-ft-thick mineralized zones occur along north-trending faults within and at the contacts between limestone, shale, and quartzite at the base of the Paleozoic sedimentary assemblage (Hazzard, 1954). Chrysocolla, malachite, and azurite occur in the zones along with iron oxides, quartz, and coarse crystalline calcite. The main zone is exposed for about 75 ft.	One 45-ft adit and two pits.	Of one grab and five chip samples, four contained 0.004 to 0.012 oz/ton gold and three contained 0.018 to 0.092 oz/ton silver. Two samples contained 1.18% and 4.7% copper, mostly in the form of secondary copper minerals. Minor lead was also detected. Gold and copper sample analyses indicate further study is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
114	Prospect.	One north-northwest-trending massive pod and numerous veinlets of specular hematite occur in, and are associated with, pegmatite dikes in a gneissic to granitic country rock. The zone is discontinuously exposed for 550 ft and is 2.6 to 4.6 ft thick.	One 12-ft-deep shaft and one pit.	In four chip samples, gold ranged from 0.0026 to 0.0035 oz/ton, silver ranged from 0.0058 to 0.044 oz/ton and iron (Fe) ranged from 3.8% to 7.1%. Size of structure and gold sample analyses indicate that the property merits further investigation.
115	Lopez No. 3 prospect.	Interbedded limestone and shale are intruded by a porphyritic andesite near the base of the Paleozoic sedimentary assemblage (Hazzard, 1954). Discordant and concordant shear zones and breccias contain some pyrite and considerable amounts of iron oxides with minor copper-oxide staining. One sulfide-rich zone is 0.3 to 1.2 ft thick, strikes east-northeast and dips 30°-40° SE.	Two adits and an inclined shaft totaling 168 ft.	Gold assays in six of eight chip samples ranged from 0.006 to 0.11 oz/ton; six silver assays ranged from 0.23 to 1.8 oz/ton; four lead values were from 1% to 9.7% and one zinc value was 2.62%. Gold, silver, lead, and zinc assay values indicate that the property merits additional investigation.
116#	Iris Fin prospect.	The actual location of this claim is uncertain. One sample was taken along a shale and limestone contact.	One pit.	One chip sample contained 0.2 oz/ton silver, 0.0099% copper, 0.015% zinc, and 0.0016% molybdenum.
117	Prospect.	A 1-ft-thick gouge zone containing chlorite strikes N. 60° E. and dips 65° SE. in shale or phyllite. An iron-oxide stained breccia pod occurs in limestone; the breccia is vuggy and yellow, red, brown, and black.	One 12-ft-long adit and one trench.	Two samples contained no gold or silver.
118#	Black Jack mine.	The deposit consists of a fault-bound, north-trending, steeply west-dipping lens or block of specular hematite with minor magnetite in limestone and shale metasediments of Paleozoic (Hazzard, 1954) age. It lies approximately 3/4 mi east of and 400 ft in elevation above the metasediment contact with Precambrian gneissic rocks underlain at shallow depths by granitic rock. The deposit crops out for 300 ft along strike, is 60 to 80 ft thick and is up to 145 ft deep.	One 45-ft-long adit, one 115-ft-deep shaft, two pits, and six diamond drill holes. Patented claim.	The deposit is estimated to contain an indicated subeconomic resource of 230,000 long tons at a grade of 55% to 60% iron. Four chip samples across large outcrops contained 52% to 60% iron, 0.02% to 0.05% phosphorus, 0.08% to 0.22% sulfur, and 3% to 24.1% SiO_2. In previous analyses by industry, iron ranged from 56% to 58%. There is no indication that resources beyond those calculated are present; the deposit appears to be bounded by faults.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
119	Kelso Placer prospect, north.	Fluvial and alluvial fan deposits consist of poorly sorted gravels and cobbles (40%-60%), sands 40%-50%, and silts or clays (<10%) of predominantly carbonate rock with minor quartzite. Claim activity consists of the Edna in 1905, the Gold Creek group in 1975, and the Kelso Placers in 1979.	None.	Of seven 0.38 ft^3 reconnaissance pan samples, three contained detectable gold. One contained three particles of subangular, flat gold weighing 0.002 mg; two particles were bright and one was dull. One sample contained four particles of bright, subangular to subrounded, chunky gold weighing 0.020 mg and a third sample contained 0.068 mg of bright, subrounded gold. Traces of garnet, zircon, and scheelite were noted in some samples; one contained a trace of hematite. Values are estimated at $0.06/$yd^3$, $0.02/$yd^3$, and less than $0.01/$yd^3$ at a gold price of $400/oz.
120#*	Lone Tree prospect.	Two shear zones, about 3 ft thick and oriented N. 25° W., 70° NE. and N. 63° E., 48° SE., intersect in buff, medium-grained, meta-igneous rock. The northeast zone contains some quartz and the northwest zone contains minor malachite.	A 13-ft adit with 16 ft of drift and a 13-ft crosscut (included in a patented claim group - plate 1, no. 121).	A 3-ft chip sample across the intersect contained 0.08% copper; no gold and silver detected.
121#**	Cornfield Springs Consolidated mine.	Pods, lenses, and stringers of massive specular hematite replace quartzite and limestone metasediments of lower Paleozoic age less than 100 ft above a contact with metaigneous rocks of unknown age. The replacement bodies are generally concordant with bedding which strikes N. 65° E. and dips 35° SE. The iron deposit crops out discontinuously for almost 400 ft, is up to 20 ft thick (up to 230 ft thick at depth), and may have been cut at a depth of 175 ft by workings not now accessible.	One 25-ft inclined shaft, two inclined adits, not accessible (reported to be 65 ft and 635 ft long by Mineral Survey no. 4692), and three pits. One 60-ft-deep shaft is apparently caved (patented claims).	Inferred subeconomic resources of 110,000 long tons contain at least 50% iron. One chip sample contained 26% iron and two random chip samples averaged 50% iron. Contact environment, literature description, and form of deposit suggest that several hundred thousand tons of additional iron resources may be present.
122**	Rex mine.	A N. 25° W. trending, steeply southwest dipping fault cuts Jurassic age, metamorphosed granitic and subvolcanic rocks. Several, localized, north-trending shear zones are also present. The fault is exposed for 170 ft and contains a brecciated, pinch and swell, quartz vein exposed for 140 ft and averaging 2.5 ft thick. Gold is restricted to the quartz vein. The fault zone is largely composed of earthy to specular hematite and is inferred to be a northern extension of the Hidden Hill fault which partly controls the Vulcan mine-Burro prospect (plate 1, no. 128).	The main working consists of 182 ft of drifts and crosscuts, two portals, two connecting 20 ft deep shafts, and possible inaccessible lower levels. Other workings include a a 10-ft-deep shaft, three trenches, and four pits. Cumulative production (USBM statistical files) for 1939 and 1951 was 126 crude tons containing 17 oz gold and 9 oz silver; small shipments reported (Wright and others, 1953) for 1934 and 1948.	The exposed vein deposit is estimated to contain an occurrence of 3,700 tons at an average grade of 0.22 oz/ton gold. Of 16 chip and 3 select samples, 9 contained detectable gold and three contained detectable silver. Gold ranged from 0.016 to 0.564 oz/ton, with 4 samples exceeding 0.1 oz/ton, and silver ranged from 0.006 to 0.7 oz/ton. None of the gold-bearing samples contained detectable silver. Less than 0.01% each of copper, lead, and zinc were detected in two samples analyzed. The major fault control, size of the mineralized structure, and the sample analyses suggest that additional vein-type gold resources may be present at depth.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
123	Kelso placer prospect, south.	Fluvial sediments are predominantly limestone in composition. Material is poorly sorted, consisting generally of 60% cobbles and gravel and 40% sand. Claim activity consists of the Saturn, Uranus, and Milky Way Claims in 1950, the Providence Placer Group in 1973, and the Kelso Placers in 1979.	None.	Of four 0.38 ft^3 reconnaissance pan samples, three contained gold. One contained a dull, chunky, subangular to subrounded particle of gold with a weight of 0.001 mg; one sample contained three bright to tarnished, subangular, chunky flakes of gold with a weight of 0.006 mg; and one sample contained 0.006 mg of bright, subangular gold. Two samples contained traces of zircon and scheelite. Sediment values are estimated to be less than \$0.01/yd^3 at a gold value of \$400/oz.
124	Bonanza 1-8 placer prospects.	Fluvial sediments consist of poorly sorted sand and pea gravel (70%-80%) with minor cobbles and fines; composition varies from predominantly syenite to limestone with some rhyolite. Heavy black sands and magnetic fraction are due to the Vulcan mine-Burro prospect (plate 1, no. 128). The Bonanza placers were located in 1979.	None.	Of five 0.38 ft^3 reconnaissance pan samples, two contained two dull, chunky, subangular to subrounded gold flakes, each with weights of 0.003 and 0.004 mg. Traces of garnet, zircon, scheelite, and hematite were also observed. Sediment values are estimated to be less than \$0.01/yd^3 at a gold price of \$400/oz.
125	Iron Mountain prospect.	Northeast-trending, brecciated shear zones occur in interbedded shale and limestone. A skarn-type mineral assemblage consists of magnetite, specular hematite, garnet, epidote, pyrite, chalcopyrite, secondary copper minerals, and quartz. The zones are localized, partially controlled by bedding, and occur very low in the Paleozoic assemblage, close to Jurassic intrusive rocks.	Two adits, 10 and 37 ft long.	Of four chip and select samples, two contained 0.4% and 3.2% copper. No gold, silver, lead, or zinc detected.
126	Prospect.	Fault gouge, 1 to 5 ft thick, is exposed along the length of an adit on a north-northeast-trending contact between limestone and rhyolite. The sheared to brecciated rocks are iron-oxide stained and contain malachite and chrysocolla.	One adit at least 150 ft long, and three pits.	Of four samples in the adit, one contained 0.016 oz/ton gold and two contained 0.2 and 0.4 oz/ton silver. A select sample from a stockpile contained 5.2 oz/ton silver and 0.74% copper. A grab sample contained 1.0 oz/ton silver and 0.23% copper. Contact environment and gold, silver, and copper values indicate the prospect merits additional study.
127**	Dolomite outcrop.	A north-northeast-trending ridge is 2,000 ft long and 1,000 ft wide at its base, and is part of the lower dolomite member of the Middle Cambrian Bonanza King Formation (Hazzard, 1954).	None.	Eight random chip samples: MgO ranged from 5.4% to 21.4%. Exclusive of one low sample, the occurrence averages 19.1% MgO; however, several samples contained high SiO_2 and Fe_2O_3. The deposit is considered an occurrence with an inferred size of 12 million tons. The areal extent of this and other dolomite units in the Paleozoic assemblage in the Providence Mountains is very large.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
128#*	Vulcan mine-Burro prospect.	A magnesium silicate skarn-type iron deposit is along a northwest-trending fault contact between Paleozoic dolomitic carbonate rocks on the north and quartz monzonite on the south. The main ore body was 700 ft long, 325 ft wide, and composed of magnetite, subordinate specular and earthy hematite, and minor limonite and pyrite. Serpentine is the major gangue mineral. A smaller deposit occurs east of the mine.	The main open pit is 1,000 ft long by 500 ft wide by 100 to 250 ft deep. Other workings are a smaller open pit, a north-trending adit, and numerous pits, trenches, and drill roads. Property consists of five patented mining claims, a patented millsite and 12 unpatented claims. Wright and others (1953) show production of 2.643 million long tons of 50% iron from 1942 to 1947. Minor production from dumps and stockpiles in the 1950's (patented claims).	Permission to enter the property was denied by Kaiser Steel. Based on published data (Lamey, 1948), the deposit is estimated to contain 3.0 million long tons of inferred, subeconomic resources averaging 50% iron. Aeromagnetic surveys and a fault contact suggest that additional resources may be present to the east.
129	Rector Not prospect.	A fault strikes N. 30° W. and dips 55° NE. in limestone near a contact between silicified malachite-, chalcopyrite-, and galena-bearing limestone and iron-oxide stained rhyolite.	One adit, 30 ft long, two open cuts, 100 ft long, and one dump (no portal found).	Of two select samples, one contained 0.014 oz/ton gold and both contained silver, 0.2 and 0.6 oz/ton. One sample contained 9.4% copper, 0.07% lead, and 0.01% zinc. Gold and copper analytical values and similar types of minerals and alteration along the extent of the fault contact in the Foshay Pass area indicate the property merits additional investigation.
130	Copper King-Queen of the Night prospect.	A fault zone approximately 4 ft thick strikes N. 5°-20° W. and dips 65° NE. in light gray, iron-oxide stained limestone. The 80-ft-long exposure is subparallel with and less than 100 ft from a contact with rhyolite. The fault zone is probably several hundred feet long. The limestone is silicified and contains blebs of malachite and azurite and veinlets of calcite. Microprobe examination showed fine-grained inclusions of cinnabar and iodyrite (AgI) in the malachite.	One shaft 20 ft deep, one adit 6 ft long, and three bulldozer cuts, each about 100 ft long.	Two chip samples contained 0.15% and 0.48% copper; no gold or silver was detected.
131	Tip Top prospect.	Fault zones are 1.0 to 3.5 ft thick and strike N. 45° W. to N. 10° E. and dip 80° NE. to 85° NW. in fractured, gray, iron-oxide stained limestone south of a rhyolite contact. Rocks contain minor to abundant malachite with chalcopyrite and possible bornite.	Three shafts, 20 to 70 ft deep, and two adits, 8 and 10 ft long.	Of two chip, two select and one grab sample, two contained silver, 0.4 and 0.6 oz/ton; no gold detected. The chip samples contained 0.08% and 0.84% copper, the grab sample contained 1.72% copper and the select samples contained 13.3% and 25% copper. The high-grade copper, the presence of silver, and the proximity to the rhyolite contact indicate further study is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
132	Burro No. 31 prospect.	Northwest-trending, vertical to northeast dipping fault zones 1.0 to 7.0 ft thick are in limestone. Two short (<50 ft) fault zones are silicified and contain quartz, calcite, iron and manganese oxides, malachite, possibly smithsonite, minor magnetite, and chalcopyrite. A 20 ft wide, prominent, fault-bound zone is internally sheared, faulted, bleached, and has localized silicification and iron-oxide staining. Fault-bound talcose zones are also contained in the main fault zone.	Two adits (68 and 250 ft long) and one pit.	Of nine chip samples, one contained a trace gold and six contained 0.1 to 0.2 oz silver/ton. Eight samples analyzed for copper, lead, and zinc contained minor to moderate values (<1%) except for one which contained 2.70% copper. The fault control, rhyolite contact, and gold and copper sample analyses indicate the property merits additional study.
133	Sunrise prospect.	Localized, 2- to 3-ft-thick shear zones are in limestone approximately 1/2 mile south of a contact with a rhyolite plug. One zone strikes north, dips 78° E., and contains subequal amounts of quartz and carbonate veining with minor iron-oxide, magnetite, and traces of malachite and chalcopyrite. Another fault trends northwest, dips steeply southwest, and contains iron- and manganese-oxides in fractures, and minor encrusted malachite.	One adit, 60 ft long, one caved adit, approximately 30 ft long, and one shaft of unknown depth.	One select contained 0.062 oz/ton gold, 18.3% copper, and 0.01% lead. One chip sample contained 0.2 oz/ton silver, 0.125% copper, 0.0045% lead, and 0.25% zinc. Gold and copper analytical values and the proximity to the rhyolite plug indicate that further study is warranted.
134**	Prospect.	North- to northwest-trending, southwest dipping shear zones 4 to 70 ft thick are locally exposed in and near a contact zone between Paleozoic carbonates and a Jurassic granitic intrusion. One zone contained a 1.6-ft-thick magnetite vein of unknown length; the hanging wall is limestone and the footwall is intrusive rock.	Two bulldozer cuts, each 100 ft, and one pit.	Of two chip samples across shear zones, one contained 0.1 oz/ton silver; copper values were < 0.002% and zinc values were < 0.007%. A chip sample across the magnetite contained 61.1% Fe_2O_3, 14.7% SiO_2, 10.9% MgO, 6.2% CaO, 1.6% MnO, 1.3% Al_2O_3, 0.15% P_2O_5, and 0.12% sulfur. Small but high-grade outcrops of magnetite along the contact zone up to 1 1/4 mi east of the Vulcan mine-Burro prospect (plate 1, no. 128) are consistent with the geologic environment attributed to that mine. Further exploration is warranted.
135**	East Burro prospect.	Three workings explore a very irregular, northeast-trending contact zone between silicified rhyolite on the north and a weathered, granitic intrusion on the south. The zone is intensely bleached, contains fragments of limestone, and exhibits chloritic alteration. The remainder of workings are in weathered, friable to sheared granitic rock without apparent structure.	Eight bulldozer cuts, each approximately 50 ft long.	Two grab samples contained 0.0011% to 0.057% copper; one contained 0.08 oz/ton silver.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
136*	Burro 54 and 55 prospect.	A deeply weathered, intensely iron-oxide altered granitic intrusion lies near a contact with a rhyolite intrusion.	One bulldozer cut 110 ft long.	One grab sample contained 0.0022% copper; no gold or silver detected.
137a	Limestone outcrop.	Hazzard (1954) described several northeast-striking, southeast-dipping, thick sections of limestone cropping out for as much as 7 miles as follows: 1) Bullion Member (250-350 ft thick) and part of the Yellowpine Member (75-125 ft thick) of the Mississippian Monte Cristo Limestone, 2) Crystal Pass (250-300 ft thick) and Upper Valentine (350-400 ft thick) Limestone Members of the Devonian Sultan Limestone, 3) Upper Cambrian Chambless Limestone (170-220 ft thick), and 4) marine derived portions of the Triassic Moenkopi Formation (500 ft thick).	None.	Of eight grab samples of limestone, two contained 85.7% and 89.4% $CaCO_3$ and six contained from 91.6% to 95.5%. Four samples contained greater than 1% SiO_2. Sample analyses suggest this limestone is suitable for cement or intermediate-grade industrial applications; it will probably not be of economic significance until the depletion of limestone resources closer to metropolitan markets.
137b	Dolomite outcrop.	Light to dark gray, subcrystalline dolomite occurs in the Cornfield Springs Formation. The unit strikes northeast and dips 30°-40° SE. Hazzard (1954) described dolomitic formations cropping out for approximately 7 miles along strike as follows: 1) Middle Cambrian Bonanza King Formation (1,875 - 2,230 ft thick); 2) lower part of the Late Cambrian Cornfield Spring Formation (650 ft thick); and 3) the Ironside Dolomite Member of the Middle Devonian Sultan Limestone (50-75 ft thick).	None.	Two grab samples of dolomite contained 19.3%-19.5% MgO, 0.23%-0.28% Fe_2O_3, 0.46%-0.51% Al_2O_3, and 0.012%-0.022% SiO_2. Sample analyses suggest this dolomite is suitable for at least intermediate-grade industrial applications; it will probably not be of economic significance until the depletion of dolomite resources closer to metropolitan markets.
137c	Quartzite outcrop.	The Prospect Mountain Quartzite section is from 50 to several hundred ft thick, crops out for approximately 3 mi, strikes east-northeast and dips 20°-40° SE. (Ver Planck, 1966). Outcrops are buff, orange, or red and may be banded due to cross bedding.	None.	One sample of quartzite contained 94.0% SiO_2; however, Fe_2O_3 is 2.3% and Al_2O_3 is 2.5%. Deposit is of doubtful economic significance for industrial grade SiO_2.
138	Prospect.	Two, 1-in.-thick quartz veins trend north in lenticular to banded gneiss east of the East Providence fault. Quartz is white to clear or light pink with occasional vugs and boxworks.	One caved inclined shaft was approximately 50 ft long.	Of two select samples of quartz, one contained 0.01 oz/ton gold, 0.2 oz/ton silver, 0.0093% copper, 0.0021% lead, and 0.0037% zinc. Gold sample value and proximity to East Providence fault suggest the prospect merits additional investigation.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
139#	Good Hope mine.	A quartz-filled, brecciated shear zone strikes east for 690 ft, dips steeply to the north and averages 2.7 ft thick. The zone is truncated on the east by a north-striking fault and on the west it disappears beneath a volcanic cap. Country rock is Precambrian metamorphic rocks with Tertiary volcanic caps on ridge tops.	Two adits, 140 and 40 ft long, connected by a raise, and three pits.	The deposit contains an indicated subeconomic resource of 4,400 tons averaging 0.070 oz/ton gold and an inferred subeconomic resource of 32,000 tons at an average grade of 0.031 oz/ton gold. Of 16 chip samples, 13 contained a trace to 0.256 oz/ton gold and 1 contained 0.2 oz/ton silver. No copper or lead were detected. The size and grade of the deposit indicate additional gold resources may be present at depth.
140	Prospect.	Workings are in a limestone-gneiss contact zone 4 to 20 ft wide along the north-trending East Providence fault. Limestone is brecciated and healed with calcite. Limonite staining and minor secondary copper minerals were observed in the gouge zone in gneiss.	One pit and one 38-ft-long adit.	Of five chip samples, two contained 0.1 oz/ton silver and one contained 0.01% copper.
141#**	Red Rock prospect.	The north-trending, east-dipping East Providence fault is exposed for approximately 2,000 ft along a contact between limestone on the west and gneiss on the east. Limestone is brown to gray and commonly brecciated throughout a 2- to 5-ft-thick zone which is calcite-hematite healed.	One partially caved vertical shaft, two adits, 4 and 10 ft long, two pits, and one exploratory drill hole.	Of one select and six chip samples, only the select sample contained trace gold. One sample contained 0.1 oz/ton silver. Copper values ranged from nil to 0.0010%, lead values from nil to 0.01%, and zinc from 0.0008% to 0.0033%. Although the assay values are low, past producers to the north and south on the same structure indicate the property merits additional investigation for resources of silver, lead, and gold.
142	Sunny Boy Extension placer prospect.	Fluvial sediments are from the Barber Canyon washes; upper tributaries are well scoured in steep, narrow canyons. The predominantly gneissic with minor volcanic sediments are 95% sand and pea gravel with 1%-5% gravel at 1 to 2 in., and 1%-2% silt and clay; black sands range from 3% to 10%. The Sunny Boy Extension was located in NW1/4 sec. 28, T. 11 N., R. 14 E., S.B.M., in 1955.	None.	No gold was observed in two 0.38 ft^3 reconnaissance pan samples; both contained traces of garnet.
143**	Petrified wood outcrop.	Agatized Sequoia *landsdorffia* occurs as float and at the base of volcanic ash beds near Barber Canyon and at the mouth of Beecher Canyon. It occurs as non-fractured rubble up to 6 in. diameter and ranges from light tan to nearly black with a distinct wood grain pattern visible in cut specimens.	One small cut in ash beds east of Whiskey Spring.	About 2 to 3 yd^3 of petrified wood float was observed in Barber Canyon. It is classed as excellent for jewelry. The price is estimated at $0.10 to $0.25/lb wholesale delivered or $1.00/lb retail for the raw product. Quantities and quality appear to be suitable for recreational use but would not support a long-term commercial operation.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
144#**	Silver King mine (Perseverance mine).	Mineralized pods and lenses in fissures and calcite and quartz cemented breccia zones 1.5 to 10 ft thick occur near fault intersections with the north-trending, east-dipping East Providence fault. Some significant metal values occur locally along 1,200 ft of the main fault and 750 ft of the west-trending splinter fault. Minerals include argentite, argentiferous galena, cerussite, silver chlorides and bromides, malachite, anglesite, and willemite.	Workings consist of 4 shafts, 7 adits, 11 trenches, and 14 pits. Adits are 10 to 30 ft long; one shaft is 50 ft deep with a 25-ft drift, and one is 162 ft deep with 1,350 ft of drifts and crosscuts. From 1918-1920, mine production (USBM statistical files) was 20 tons containing 6.98 oz gold, 1,489 oz silver, 11 lb copper, and 232 lb lead. Tucker (1920) estimated $250,000 production in 1880's.	Of 41 chip, 4 random chip, and 2 grab samples, 14 contained detectable gold and 27 contained detectable silver. Six contained a trace and 8 contained 0.01 to 0.04 oz/ton gold. Thirteen contained 0.1 to 0.9 oz/ton and 14 ranged from 1.9 to 7.7 oz/ton silver. Copper ranged from 0.0005% to 0.0098% in 26 of 27 samples analyzed, lead ranged from 0.0021% to 0.266% in 21 of 22 samples analyzed, and zinc ranged from 0.0051% to 0.36% in 22 samples analyzed. Production history and assay values suggest additional silver, gold, lead, and copper resources may be present at depth. Based on the surface exposure, mineralized zones are expected to be about 5,000 to 10,000 tons.
145**	Silver Queen-Golden Horse placer prospects.	Predominantly coarse sands and gravels of gneissic composition are from a north-trending dry wash which passes through 3 mi of sheared and altered rocks along the hanging wall of the East Providence Fault. The Silver Queen and Golden Horse claims were located in 1955 and 1961, respectively, in the W1/2 sec. 33, T. 11 N., R. 14 E., S.B.M.	None.	One 0.38 ft^3 reconnaissance pan sample from the active channel contained three gold particles with a total weight of 0.008 mg. The gold was dull, chunky, and subrounded to subangular. Value of the material is estimated to be less than $0.01/$yd^3$ at a gold value of $400/oz.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
146#*	Bonanza King mine.	The deposit occurs as 4- to 20-ft-thick replacement bodies in brecciated carbonate rocks along an echelon cross-breaks (tension fractures) between the north-northeast-trending, east-dipping East Providence fault and a westerly dipping or vertical boundary fault on the west. The bounding faults diverge with depth; having a 100 ft span at the surface and a 500 ft span on the 5th level of the main working. Mineralized zones are recognized by calcite and red iron-oxide in fractures and contain one or more of the following: argentite, cerargyrite, bromyrite, galena, cerussite, sphalerite, smithsonite, malachite, and pyrite.	Workings consist of one large multilevel development, one tunnel, seven adits, (three caved), six trenches, and seven pits. The three larger adits total 560 ft of drifts and crosscuts. The large working consists of an 800-ft-deep shaft (500 ft vertical and 300 ft inclined) which serviced eight levels; an intermediate level and five main levels are accessible and total more than 7,400 ft. The overall main working is developed by about 20,000 ft of drifts, crosscuts, stopes, and manways (Wright and others, 1953). Production from 1883-1887 was valued at $1.8 million, primarily from silver (Mining World, Feb. 6, 1906, p. 225-226), and more than 5,302 tons produced from 1901-1960 contained 56.57 oz gold, 82,272 oz silver, 913 lb copper, 69,275 lb lead, and 2,312 lb zinc (USBM statistical files) (patented claims).	On-site dumps and tailings contain 19,000 tons of inferred subeconomic resources averaging 4.1 oz/ton silver. Seventy-three chip, 18 random chip, 3 grab, and 1 select sample taken. Of 32 samples with gold, 14 contained a trace, 17 contained 0.0002 to 0.23 oz/ton and 1 contained 1.28 oz/ton. Thirty-seven samples contained 0.04 to 0.9 oz/ton silver, 23 contained 1.0 to 8.6 oz/ton silver, 8 contained 12.8 to 56.6 oz/ton silver, and 1 contained 75.5 oz/ton silver. Copper, lead, and zinc are ubiquitous; copper values were generally 0.001% to 0.01% while lead and zinc values were an order of magnitude higher. Five lead values and four zinc values occur in the range of 1%-5%. Production data, mapping and sampling data, and drill intercepts indicate the property merits further investigation for additional silver, gold, lead, copper, and zinc resources at depth.
147*	Dimension stone quarry.	Orange, buff, and gray welded tuff beds crop out on a small hill adjacent to the East Providence fault.	One quarry. Possible production of several hundred tons of dimension stone used to construct buildings of Providence townsite.	No samples. Large tonnage available of stone primarily suitable as a dimension stone. The quarried stone must usually be split or cut which would increase the cost and, therefore, decrease profitability. The deposit is not considered to be economically significant except for local use.
148**	BC prospect.	Weathered, Precambrian, metamorphosed, intrusive rocks with iron staining, abundant epidote and rare magnetite veinlets. One minor shear zone strikes N. 20° E. is vertical and contains minor magnetite. This area coincides with a significant aeromagnetic anomaly and was part of a regional area (Vulcan mine-Burro prospect, no. 128) explored by U.S. Steel in the early 1960's. The magnetite skarn pod at the Adams-Ikes Hope prospect (plate 1, no. 149) may be related to this deposit.	Two dozer cuts, two pits, and a slant drill hole of unknown depth; workings spread over about 1/2 mi^2.	Of one chip and one select sample, no gold or silver were detected and only minor copper and lead were detected in one sample. Based on the exploration history, the aeromagnetic anomaly, and the presence of a nearby, small iron body (Adams-Ikes Hope prospect), this prospect should be studied in detail to determine whether or not resources are present.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
149#	Adams-Ikes Hope prospect.	Lower workings are on shear zones oriented N. 50° W., vertical and N. 75° E., 85° SE. in metamorphosed rocks; one is intruded by a vuggy, clear, 8-in.-thick quartz vein containing pyrite, chalcopyrite, iron-oxides, and secondary copper minerals. Upper workings are on a N. 10° E. trending skarn lens of pyrite and magnetite with epidote and garnet. The lens is approximately 50 ft wide and is traceable by float for as much as 200 ft downslope.	One 15-ft shaft and two pits are on quartz and alteration zones; one 20-ft adit and one pit are on the magnetite zone.	Of three chip samples of vein and shear zones, one contained 0.036 oz/ton gold, two contained 0.3 and 2.1 oz/ton silver, copper ranged from 0.03% to 0.18%, and lead ranged from 0.01% to 2.7%. Two samples from the magnetite lens contained 25.7% and 38.% iron, 6.8% and 3.6% Al_2O_3, and 34.3% and 20.5% SiO_2. One contained 21.8% sulfur. Gold, silver, and lead sample analyses indicate the property merits additional investigation. The magnetite body is indicative of the need for detailed studies of the BC prospect (no. 148).
150#	Grande 1-7 mine.	One prominent vein system trends northwest, dips northeast, and crops out for at least 400 ft. The structure is exposed for 140 ft vertically, averages 2.7 ft thick, and contains veins, pods, and blebs of quartz in a gray-green gouge. Nearby, three veins and shear zones cut granitic rock; one contains red jasper with galena and minor secondary copper minerals.	A 90-ft adit with an 8-ft winze, two 15-ft adits, and five pits. Vredenburgh (1982) reported 100 tons of unknown type ore produced in 1980 from this or the Max Dor 1 and 2 mine.	One select and nine chip samples. Gold detected in four of seven samples from main vein, 0.010, 0.216, 2.144, and 2.182 oz/ton, and in two of three samples from nearby structures, 0.042 and 0.130 oz/ton. The jasper contains 2.6 oz/ton silver and three samples from the main structure contained 0.5, 3.2, and 9.4 oz/ton silver. Nine samples contained 0.03% to 0.92% and one contained 8.50% lead. Copper in four samples ranged from 0.02% to 0.26%. Erratic but high gold and silver values and persistence of structure indicate that further studies may reveal additional vein-type, gold and silver resources at depth.
151	Raindrop prospect.	Localized, 0.5-ft-thick, white quartz veins are oriented N. 60° E., 72° NW. and N. 28° W., 24° NE. in granitic rock; quartz contains abundant limonite pseudomorphs after pyrite.	Three trenches, 40 to 100 ft long.	Two samples contain 0.01% and 0.09% lead; no gold or silver detected.
152#	Why Not Nos. 1-5 prospect.	At least eight quartz vein segments 0.5 to 4.4 ft thick, most trending northwest, occupy local shears or faults in Jurassic granitic rock. The longest vein is traced for 350 ft and may be up to 900 ft long. Quartz is commonly white, vuggy, and brecciated and contains pyrite, limonite, minor galena, and traces of secondary copper minerals.	Two adits, 8 and 35 ft long, two shafts, 10 and 15 ft deep, three trenches and eight pits.	Of nine chip, one random, and two select samples, seven contained detectable gold and four contained silver. Gold ranged from 0.012 to 0.118 oz/ton and averaged 0.057 oz/ton; 3 contained from 0.2 to 0.5 oz/ton silver and 1 contained 1.8 oz/ton silver; lead detected in 11 samples ranged from 0.03% to 0.8% and copper ranged from 0.01% to 0.09% in seven samples. Gold and silver sample analyses and number and type of veins suggest that further exploration is warranted.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
153#	Max Dor 1 and 2 mine.	Two major structures: an east-trending, north-dipping quartz vein crops out discontinuously for 2,300 ft and a 300-ft spur, and a northwest-trending, northeast-dipping fault exposed for about 350 ft in granitic rocks. The 0.6- to 6.5-ft-thick quartz vein is white to clear and contains pyrite, chalcopyrite, malachite, and azurite. The fault is 1 ft thick and composed of green gouge with quartz.	Three small pits, an open pit, four trenches, two dozer cuts, and a 47-ft shaft with 25 ft of crosscuts and drifts. Vredenburgh (1982) reported 100 tons of unknown type ore produced in 1980 from this or the Grande 1-7 mine.	One select and 15 chip samples. Three of 13 samples from quartz veins contained 0.020 to 0.082 oz/ton gold and 3 samples from the fault contained 0.012 to 0.590 oz/ton gold. One sample contained 0.3 oz/ton silver, 10 contained 0.01% to 0.12% copper and 10 contained from 0.01% to 2.38% lead. Based on significant values and prominent structures, this property merits further study for gold with byproduct silver and lead resources at depth.
154#	Gold Star North 1-44 prospect.	Variably-trending, generally easterly-dipping, localized, 0.1- to 2.8-ft-thick shear zones and narrow quartz veins are associated with a northeast-trending, up-to-several-hundred-ft-wide zone of pervasively and intensively altered intrusive rock. This is a north extension of the Gold Star 1-10 prospect (plate 1, no. 155). Quartz is white to clear and contains pyrite, limonite pseudomorphs after pyrite, siderite, specularite, chrysocolla, malachite, azurite, and possible chalcopyrite.	One 50-ft-deep inclined shaft, two adits, 20 and 60 ft long, and seven pits.	Of 16 samples, 4 contained from 0.010 to 0.324 oz/ton gold and 2 contained silver, 0.4 and 2.3 oz/ton. Of 10 analyzed for copper, 9 contained from 0.03% to 0.72%. The prominent, pervasively altered zone and the sample analyses indicate additional investigation is warranted for vein-type gold and silver with byproduct copper resources at depth.
155#	Gold Star 1-10 prospect.	Localized, north-trending, east-dipping, 0.5- to 7.8-ft-thick quartz veins and shear zones are along a 60- to 400-ft-wide zone of pervasively and intensively altered intrusive rock. This is a south extension of the Gold Star North 1-44 prospect (plate 1, no. 154). The altered zone extends for approximately 1 mi along a north-northeast trend.	Four inclined shafts, 17 to 55 ft deep, including 55 ft of drifts, two trenches, and six pits.	Of 25 samples, 3 contained a trace to 0.072 oz/ton gold. Five analyzed for copper contained 0.0009% to 0.02% and four of five analyzed for lead ranged from 0.03% to 0.47%. Based on sporadic gold assays and south extension of Gold Star North 1-44 prospect, this property warrants further investigation for gold with byproduct lead and copper resources.
156	Prospect.	A north-trending, 30°-50° W. dipping, 4-in.- to 1-ft-thick quartz vein is exposed for 90 ft in a shear zone cutting metamorphosed igneous rock shear. The shear is composed of punky clay gouge and limonite, and the quartz contains visible galena.	One 90-ft-long adit with at least a 40-ft partially caved crosscut, and one 40-ft trench.	Of four chip samples, two contained 3.2 and 4.3 oz/ton silver and two contained 0.2 and 0.3 oz/ton silver. Lead values ranged from 0.02% to 1.27%. No gold was detected. Silver and lead sample values indicate the prospect merits additional study.
157	Pink Falcon prospect.	Several graphic textured, generally northwest-trending 1- to 3-ft-thick dikes with pink to purple feldspar, abundant white to clear quartz, and minor biotite are exposed for about 20 ft. Some quartz exhibits comb structures with hematitic jasper banding. Hornblende diorite country rock exhibits intense to sericite and chlorite alteration.	Three shafts, 10 to 20 ft deep.	Of one grab and three chip samples, two contained 0.01% and 0.02% copper; no gold, silver, or molybdenum detected.

APPENDIX B.--Summary description of mines, prospects and mineralized outcrops in and adjacent to the Providence Mountains study area, San Bernardino County, CA--Continued

Map no.	Name	Summary	Workings and production	Sample and resource data
158*	Prospect.	Fault and shear zones strike north to northwest, dip moderately west, and are associated with quartz fillings in granite gneiss country rock. The main zone crops out discontinously for 320 ft and contains narrow (< 6 in.) quartz veins and lenses. Other than minor galena, no significant minerals were observed.	Two inclined shafts, 25 and 70 ft deep, one 30-ft adit, and six pits.	Six chip and one select sample contained no detectable gold or silver. One chip sample with visible galena contained 0.76% lead.
159	Lou-Al-Mark Nos. 1-3 prospect.	A north-trending, vertical zone of fault gouge 1.3 ft thick with silicified hematite-limonite stringers occurs in granitic country rock. The surface expression along the drainage between pits is approximately 500 ft.	Two pits.	One chip sample had 0.02% lead; no gold or silver were detected.
160*	Prospect.	Localized shear zones in granite gneiss strike N. 85° W. and dip 33° SW. One contains an aplite dike with abundant chrysocolla staining and the other contains 1- to 3-in.-thick veins with drusy and comb quartz structures. Sinuous cavities in the quartz are filled with bladed barite up to 1 in. long with interstital galena and chlorite.	Two pits and two small trenches.	Two samples taken: a grab sample contained 2.05% copper and 0.12% barium and a select sample contained 1.0 oz/ton silver, 0.01% copper, 8.8% lead, and 11.8% barium. Silver, lead, copper, and possibly barium sample values indicate the prospect merits further study.
161	Silver Duchess prospect.	A 2-ft-thick quartz vein, bordered by fault gouge in granitic rock, strikes N. 17° W. and dips 82° N. with pyrite and iron oxide in fractures.	Two pits and one collapsed shaft or adit.	One chip and one select sample; no gold or silver detected.
162*	Prospect.	An argillized alaskite dike 8 ft thick trends N. 10°-20° W. in pegmatite granite; only locally exposed.	One pit.	One random chip; no gold, silver, or copper detected.

APPENDIX C.--A GUIDE TO APPROXIMATE MINING AND MILLING COSTS

1) Intent

Tables C-1 and C-2 are intended to be used as comparative guides to production costs for selected mining and milling conditions. Actual data for a particular deposit or group of deposits may be substituted for assumed values as they become available. Table C-1 lists mine and mill costs for small to moderate-sized underground operations, and table C-2 lists costs for large-tonnage deposits mined by surface methods.

2) Assumptions

The reader must either have detailed information on the following deposit characteristics or make appropriate assumptions to determine the approximate mining and milling costs:

Deposit Characteristic	Elements Affecting Unit Cost
size	mining rate 1/ mine life power requirements
geometry	mining method transportation
grade and metallurgy	beneficiation method recovery return

3) Qualifications

The cost estimates in tables C-1 and C-2 are modified, by extrapolation or interpolation of cost curves or formulas, from STRAAM (Clement and others, revised 1979), a multivariable analysis of the cost elements of numerous mining and milling operations. Production rates in STRAAM were generally limited to 100 to 1,000 tons/day. In some cases the data were based on the assumption that the proportion of one element to another, such as mine equipment cost relative to the total mine capital cost, is relatively constant. Because the curves and formulas in STRAAM are limited to the spectrum of methods and rates represented, estimates may vary from actual costs by as much as 25%.

1/ The mine and mill production rate for underground operations is held constant so that other variables may be compared. In general, if the production rate increases, then total capital costs increase and operating costs decrease on a per ton basis.

TABLE C-1.--A guide to approximate mining and milling costs to produce minerals from small underground mines

(All estimates based on a production rate of 100 ton/d for 250 d/yr)

(<, less than; *, select appropriate cost; d, diesel; c, commercial)

MAJOR COST ELEMENTS AND OPTIONS	COST 1/ BY DEPOSIT SIZE ($/ton)				
	10,000 ton	25,000 ton	50,000 ton	100,000 ton	300,000 ton
			MINING COSTS		
Access roads: (20 ft wide; 6 miles easy 5% slope and 2 miles difficult 30% slope)	3	1	<1	<1	<1
Power capital cost:					
Diesel	10 .... *	4 ...... *	2 ....*	1 .... *	<1 .... *
Commercial (6 mile line)	43	17	9	4	<1
Mine capital cost:	182	73	36	18	6
Mine operating cost: (4 ft mining width; open or shrinkage stope)	52^{d}, 49^{c}..... *	52^{d}, 49^{c}..... *	52^{d}, 49^{c}.....*	52^{d}, 49^{c}..... *	52^{d}, 49^{c}
			MILLING COSTS (ON SITE)		
Mill capital cost:					
Agitation cyanide leach	208 .... *	84 .... *	43 .... *	22 .... *	8 .... *
Heap leach (agglomeration)	42	17	8	4	1
Mill operating cost:					
Agitation cyanide leach	32^{d}, 29^{c} .... *	32^{d}, 29^{c} ..... *	32^{d}, 29^{c} .....*	32^{d}, 29^{c} .... *	32^{d}, 29^{c} .... *
Heap leach (agglomeration)	10 2/	10	10	10	10
Transportation to mill: (25 ton/load, 10 mi/h, 2 miles)	2	2	2	2	2
			MILLING COSTS (OFF SITE)		
Custom mill at Ivanpah, CA: (agitation cyanide leach)	25-30	25-30	25-30	25-30	25-30
Transportation to mill: (25 ton/load, 30 mi/h, 40 miles)	10	10	10	10	10

1/ July 1984 costs modified from STRAAM (Clement and others, revised, 1979)
2/ A heap leach mill does not require commercial electric power.

TABLE C-2.--A guide to approximate mining and milling costs to produce minerals from open-pit mines

(Production rates varied to optimize mine life in the range of 10 to 40 yr)

(*, select appropriate cost)

MAJOR COST ELEMENTS AND OPTIONS	COST 1/ BY DEPOSIT SIZE AND PRODUCTION RATE ($/ton)			
	300,000 tons (100 ton/day, 12 yr life)	1 million tons (400 ton/d, 10 yr life)	5 million tons (1,000 ton/d, 20 yr life)	10 million tons (1,000 ton/d, 40 yr life)
Access road: (6 miles easy, 5% slope; 2 miles difficult, 30% slopes)	0.10	0.03	0.01	0.01
Power: (commercial)	1.43	.43	.09	.04
Truck transportation: (mine to mill, 1 mile, 10 mi/h, noncontract	1.93	1.93	1.93	1.93
Mine capital cost: (open pit, drill and blast)				
No stripping	1.25 ...... *	1.24 ..... *	.39 ..... *	.20 ..... *
1:1 stripping ratio	2.74	1.93	.61	.30 ..... *
Mine operating cost: (open pit, drill and blast)				
No stripping	10.08 ...... *	6.03 ..... *	4.31 ..... *	4.31 ..... *
1:1 stripping ratio	20.16	12.06	8.61	8.61
Mill capital cost:				
Agitation cyanide leach	8.02 ...... *	6.52 ..... *	3.19 ..... *	2.17 ..... *
Heap leach (agglomeration)	1.39	1.62	.56	.28
Mill operating cost:				
Agitation cyanide leach	28.54 ...... *	14.57 ..... *	10.52 ..... *	10.52 ..... *
Heap leach (agglomeration)	10.24	7.47	5.35	5.35

1/ July 1984 costs modified from STRAAM (Clement and others, revised, 1979)

Operating costs (per ton) remain approximately constant for a given method and typical production rate; however, mine and beneficiation capital costs (per ton) are generally substantially higher for small deposits. In some cases, small deposits could be produced at lower unit cost by a small operator with used equipment. A small, portable mill and/or leach pads could further reduce capital expenditures. A small two to five employee operation with appropriate used equipment and minimal development and support facilities might be profitable where a larger operation would fail. The costing tables are only a general guide for the evaluation of operations of 100 tons/day or more. A detailed costing procedure based on specific deposit characteristics would be needed to determine the feasibility of mining a given resource.

MINES, PROSPECTS, AND MINERALIZED OUTCROPS
PROVIDENCE MOUNTAINS STUDY AREA

(commodities listed,
resources underlined)

Au Gold	Ag Silver	Cu Copper
Pb Lead	Zn Zinc	Mo Molybdenum
Ba Barium	CaO Lime	MgO Magnesia
Fe Iron		SiO_2 Silica
	Stone Petrified wood	

Numerical listing

1. Prospect (Ag)
2. Prospect
3. Regulus-Vega-Spica prospect (Ag, Au, Cu, Pb) (Silver Fox shaft)
4. White Rock prospect (Ag)
5. Prospect
6. Prospect
7. Red Silver prospect (Ag, Pb, Cu)
8. Prospect (Ag, Pb, Zn)
9. Prospect
10. Silver Buddy mine (Ag, Pb, Cu,)
11. Silver Buddy prospect , south (Ag, Au, Pb, Zn, Cu)
12. Prospect
13. Sadr prospect (Ag, Pb, Au)
14. Fremont-Easy Street prospect (Au, Ag, Pb)
15. Prospect (Ag, Au, Pb)
16. Prospect
17. Denib mine (Ag, Au, Pb, Zn)
18. Blue Rock Nos. 1-6 mine (W, Ag, Au, Cu) (Confidence Copper mine)
19. Prospect
20. Prospect (Ag)
21. Prospect
22. Francis mine (Ag, Cu, Pb, Zn)
23. Castor-Pollux mine (Ag,Au,Cu,Pb,Zn) (Columbia mine, Macedonia mine)
24. Monte Video prospect (Au, Ag)
25. Prospect
26. Prospect
27. Fanny No. 2 prospect (Au, Ag)
28. Prospect (Au)
29. Rex Nos. 1 and 2 prospect
30. Prospect (Au, Ag)
31. Prospect (Au, Ag)
32. Dixie No. 2 prospect (Au, Ag)
33. Prospect (Au, Ag)
34. SS No. 28 prospect, north (Au, Ag)
35. SS No. 29 prospect, north (Au, Ag, Mo)
36. Prospect (Au, Ag)
37. SS Nos.17-19 prospect, north (Au, Ag, Zn, Mo)
38. SS Nos.20-22, 27-29 mine, south (Au, Ag, Cu, Pb, Zn, Mo) (Star [?] mine)
39. SS No. 40 prospect
40. SS No. 36 prospect
41. SS No. 38 prospect
42. SS No. 17 prospect, south (Mo)
43. SS No. 18 prospect, south
44. Hoot Owl prospect, (Au)
45. Prospect (Au, Ag)
46. Triple 10 Nos. 1-3 prospect (Au, Ag, Pb)
47. Blue Jay No. 1 prospect (Ag, Au)
48. Decorative stone quarry (stone)
49. Doodle Bug-Wild Cat-Wild Horse placer prospects
50. Prospect
51. Frisco No. 1 prospect (Au)
52. SS No. 7 prospect (Au)
53. Prospect (Au)
54. Prospect (Au, Ag)
55. Prospect (Au, Ag, Pb)
56. Prospect (Au)
57. Globe mine (Au, Ag, Mo)
58. Prospect (Au)
59. Prospect (Au, Ag)
60. Prospect (Au, Ag)
61. Prospect (Au)
62. Clamento No. 3 prospect (Au, Ag, Cu, Pb)
63. Prospect (Au, Ag)
64. Frisco No. 3 mine (Au, Ag, Pb)
65. Prospect (Au, Ag)
66. Prospect (Au, Ag)
67. SS Nos. 51,52,60 and 61 prospect (Pb)
68. Prospect (Au, Ag)
69. Double H Nos. 1 and 2 mine (Au, Ag, Cu, Pb, Zn)
70. Santa Anita-Beecher Canyon placer prospects
71. Orro Platta prospect (Au, Ag, Pb)
72. Providence mine (Au, Ag, Pb, Cu)
73. SS Nos.63, 64 prospect (Ag)
74. Prospect
75. Terry placer prospect
76. Prospect (Au, Ag, Pb)
77. Okaw mine (Au, Ag, Pb, Cu)
78. Prospect (SiO_2)
79. Prospect (Au)
80. Prospect (Au)
81. Prospect
82. Prospect
83. Del No. 2 prospect, north extension
84. Prospect
85. Prospect
86. Del No. 2 prospect
87. Firefly-White Eagle-Star placer prospects
88. SS No. 49 propsect
89. Del No. 2 prospect, south extension
90. Prospect (Au)
91. Prospect
92. Prospect (Au)
93. Silver Queen I-XXXIII prospect (Au, Ag, Pb)
94. First Chance placer prospects
95. Prospect
96. Jo Je mine (Au, Ag)
97. Morning Star prospect (Au)
98. Prospect (Au)
99. Green Scorpion prospect (Au)
100. Independence prospect
101. Greek prospect (Ag)
102. Fan 1-5 prospect (Au, Ag, Pb)
103. Prospect
104. Pink Jack prospect (Au)
105. Prospect (Au, Ag, Pb, Cu)
106. Prospect (Au)
107. Prospect (Au, Ag, Pb, Cu)
108. L'Chacana prospect (Au, Pb, Ag, Zn)
109. Prospect
110. Prospect (Au)
111. Prospect
112. Tough Nut mine (Au, Ag, Pb, Zn)
113. Lopez No. 1 prospect (Au, Cu)
114. Prospect (Au)
115. Lopez No. 3 prospect (Au, Ag, Pb, Zn)
116. Iris Fin prospect
117. Prospect
118. Black Jack mine (Fe)
119. Kelso placer prospect, north
120. Lone Tree prospect
121. Cornfield Springs Consolidated mine (Fe)
122. Rex mine (Au)
123. Kelso placer prospect, south
124. Bonanza 1-8 placer prospects
125. Iron Mountain prospect
126. Prospect(Au, Ag, Cu)
127. Dolomite outcrop (MgO)
128. Vulcan mine-Burro prospect (Fe)
129. Rector Not prospect (Au, Cu)
130. Copper King-Queen of the Night prospect
131. Tip Top prospect (Cu, Ag)
132. Burro No. 31 prospect (Au, Cu)
133. Sunrise prospect (Au, Cu)
134. Prospect (Fe)
135. East Burro prospect
136. Burro 54 and 55 prospect
137a. Limestone outcrops (CaO)
137b. Dolomite outcrops (MgO)
137c. Quartzite outcrops
138. Propsect (Au)
139. Good Hope mine (Au)
140. Prospect
141. Red Rock prospect (Ag, Pb, Au)
142. Sunny Boy Extension placer prospect
143. Petrified wood outcrop (petrified wood)
144. Silver King mine (Ag, Au, Pb, Cu) (Perseverance mine)
145. Silver Queen-Golden Horse placer prospects
146. Bonanza King mine (Ag, Au, Pb, Cu, Zn)
147. Dimension stone quarry (stone)
148. BC prospect (Fe)
149. Adams-Ikes Hope prospect (Au, Ag, Pb)
150. Grande 1-7 mine (Au, Ag)
151. Raindrop prospect
152. Why Not No. 1-5 prospect (Au, Ag)
153. Max Dor 1 and 2 mine (Au,Ag,Pb)
154. Gold Star North 1-44 prospect (Au, Ag, Cu)
155. Gold Star 1-10 prospect (Au, Pb, Cu)
156. Prospect (Ag, Pb)
157. Pink Falcon prospect
158. Prospect
159. Lou-Al-Mark No. 1-3 prospect
160. Prospect (Ag, Pb, Cu, Ba)
161. Silver Duchess prospect
162. Prospect

Alphabetical Listing

149	Adams-Ikes Hope prospect (Au, Ag, Pb)
148	BC prospect (Fe)
118	Black Jack mine (Fe)
47	Blue Jay No. 1 prospect (Ag, Au)
18	Blue Rock Nos. 1-6 mine (W, Ag, Au, Cu) (Confidence Copper mine)
124	Bonanza 1-8 placer prospects
146	Bonanza King mine (Ag, Au, Pb, Cu, Zn)
132	Burro No. 31 prospect (Au, Cu)
136	Burro 54 and 55 prospect
23	Castor-Pollux mine (Ag, Au, Cu, Pb, Zn) (Columbia mine, Macedonia mine)
62	Clamento No. 3 prospect (Au, Ag, Cu, Pb)
130	Copper King-Queen of the Night prospect
121	Cornfield Springs Consolidated mine (Fe)
48	Decorative stone quarry (stone)
86	Del No. 2 prospect
83	Del No. 2 prospect, north extension
89	Del No. 2 prospect, south extension
17	Denib mine (Ag, Au, Pb, Zn)
147	Dimension stone quarry (stone)
32	Dixie No. 2 prospect (Au, Ag)
127	Dolomite outcrop (MgO)
137b	Dolomite outcrops (MgO)
49	Doodle Bug-Wild Cat-Wild Horse placer prospects
69	Double H Nos. 1 and 2 mine (Au, Ag, Cu, Pb, Zn)
135	East Burro prospect
102	Fan 1-5 prospect (Au, Ag, Pb)
27	Fanny No. 2 prospect (Au, Ag)
87	Firefly-White Eagle-Star placer prospects
94	First Chance placer prospect
22	Francis mine (Ag, Cu, Pb, Zn)
14	Fremont-Easy Street prospect (Au, Ag, Pb)
51	Frisco No. 1 prospect (Au)
64	Frisco No. 3 mine (Au, Ag, Pb)
57	Globe mine (Au, Ag, Mo)
155	Gold Star 1-10 prospect (Au, Pb, Cu)
154	Gold Star North 1-44 prospect (Au, Ag, Cu)
139	Good Hope mine (Au)
150	Grande 1-7 mine (Au, Ag)
101	Greek prospect (Ag)
99	Green Scorpion prospect (Au)
44	Hoot Owl prospect (Au)
100	Independence prospect
116	Iris Fin prospect
125	Iron Mountain prospect
96	Jo Je mine (Au, Ag)
119	Kelso placer prospect, north
123	Kelso placer prospect, south
108	L'Chacana prospect (Au, Pb, Ag, Zn)
137a	Limestone outcrops (CaO)
120	Lone Tree prospect
113	Lopez No. 1 prospect (Au, Cu)
115	Lopez No. 3 prospect (Au, Ag, Pb, Zn)
159	Lou-Al-Mark No. 1-3 prospect
153	Max Dor 1 and 2 mine (Au,Ag,Pb)
24	Monte Video prospect (Au, Ag)
97	Morning Star prospect (Au)
77	Okaw mine (Au, Ag, Pb, Cu)
71	Orro Platta prospect (Au, Ag, Pb)
143	Petrified wood outcrop (petrified wood)
157	Pink Falcon prospect
104	Pink Jack prospect (Au)
1	Prospect (Ag)
2	Prospect
5	Prospect
6	Prospect
8	Prospect (Ag, Pb, Zn)
9	Prospect
12	Prospect
15	Prospect (Ag, Au, Pb)
16	Prospect
19	Prospect
20	Prospect (Ag)
21	Prospect
25	Prospect
26	Prospect
28	Prospect (Au)
30	Prospect (Au, Ag)
31	Prospect (Au, Ag)
33	Prospect (Au, Ag)
36	Prospect (Au, Ag)
45	Prospect (Au, Ag)
50	Prospect
53	Prospect (Au)
54	Prospect (Au, Ag)
55	Prospect (Au, Ag, Pb)
56	Prospect (Au)
58	Prospect (Au)
59	Prospect (Au, Ag)
60	Prospect (Au, Ag)
61	Prospect (Au)
63	Prospect (Au, Ag)
65	Prospect (Au, Ag)
66	Prospect (Au, Ag)
68	Prospect (Au, Ag)
74	Prospect
76	Prospect (Au, Ag, Pb)
78	Prospect (SiO_2)
79	Prospect (Au)
80	Prospect (Au)
81	Prospect
82	Prospect
84	Prospect
85	Prospect
90	Prospect (Au)
91	Prospect
92	Prospect (Au)
95	Prospect
98	Prospect (Au)
103	Prospect
105	Prospect (Au, Ag, Pb, Cu)
106	Prospect (Au)
107	Prospect (Au, Ag, Pb, Cu)
109	Prospect
110	Prospect (Au)
111	Prospect
114	Prospect (Au)
117	Prospect
126	Prospect (Au, Ag, Cu)
134	Prospect (Fe)
138	Prospect (Au)
140	Prospect
156	Prospect (Ag, Pb)
158	Prospect
160	Prospect (Ag, Pb, Cu, Ba)
162	Prospect
72	Providence mine (Au, Ag, Pb, Cu)
137c	Quartzite outcrops
151	Raindrop prospect
129	Rector Not prospect (Au, Cu)
141	Red Rock prospect (Ag, Pb, Au)
7	Red Silver prospect (Ag, Pb, Cu)
3	Regulus-Vega-Spica prospect (Ag, Au, Cu, Pb) (Silver Fox shaft)
122	Rex Mine (Au)
29	Rex Nos. 1 and 2 prospect
13	Sadr prospect (Ag, Pb, Au)
70	Santa Anita-Beecher Canyon placer prospects
10	Silver Buddy mine (Ag, Pb, Cu)
11	Silver Buddy prospect, south (Ag, Au, Pb, Zn, Cu)
161	Silver Duchess prospect
144	Silver King mine (Ag, Au, Pb, Cu) (Perseverance mine)
93	Silver Queen I-XXXIII prospect (Au, Ag, Pb)
145	Silver Queen-Golden Horse placer prospect
52	SS No. 7 prospect (Au)
42	SS No. 17 prospect, south (Mo)
37	SS Nos.17-19 prospect, north (Au, Ag, Zn, Mo)
43	SS No. 18 prospect, south
38	SS Nos.20-22, 27-29 mine, south (Au, Ag, Cu, Pb, Zn, Mo) (Star [?] mine)
34	SS No. 28 prospect, north (Au, Ag)
35	SS No. 29 prospect, north (Au, Ag, Mo)
40	SS No. 36 prospect
41	SS No. 38 prospect
39	SS No. 40 prospect
88	SS No. 49 prospect
67	SS Nos.51,52, 60 and 61 prospect (Pb)
73	SS Nos.63, 64 prospect (Ag)
142	Sunny Boy Extension placer prospect
133	Sunrise prospect (Au, Cu)
75	Terry placer prospect
131	Tip Top prospect (Cu, Ag)
112	Tough Nut mine (Au, Ag, Pb, Zn)
46	Triple 10 Nos. 1-3 prospect (Au, Ag, Pb)
128	Vulcan mine-Burro prospect (Fe)
4	White Rock prospect (Ag)
152	Why Not Nos. 1-5 prospect (Au, Ag)

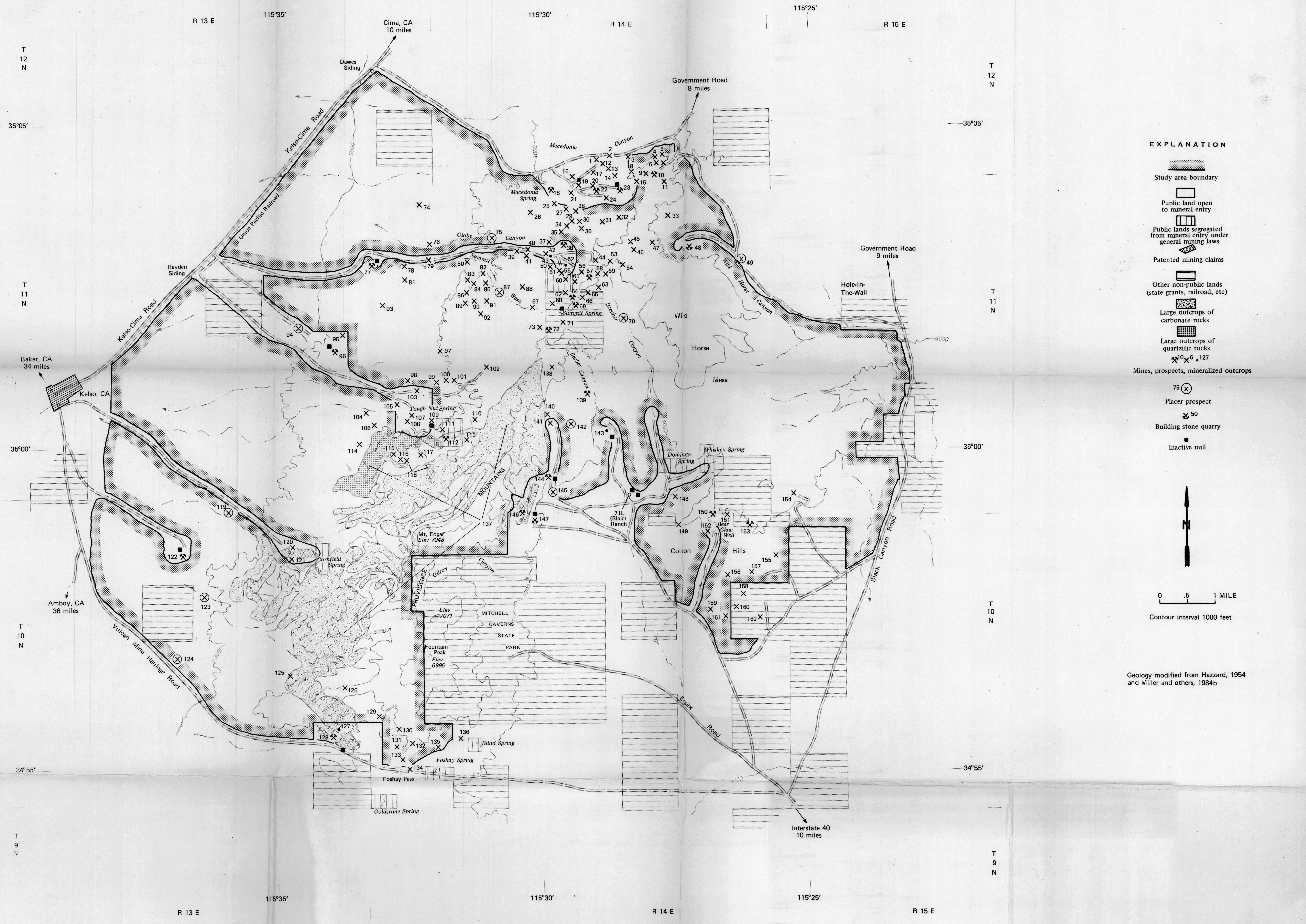


PLATE 1. – Mines, prospects, mineralized outcrops, and land status in the Providence Mountains study area